

# Run 14 RHIC Machine/Experiments Meeting

3 June 2014

## Agenda:

- **Run 14 Schedule** (Pile)
- **Machine Status** (Robert-Demolaize)
- **STAR and PHENIX Status** (Experiments)
- **Other**

**Call in bridge line is 631-344-8383**

# Run 14 plan based on 22 weeks cryo operation

and Fischer et.al. RHIC Collider Projections (FY 2013 – FY 2017), 4 Jun 2013

(5/20/15 update)

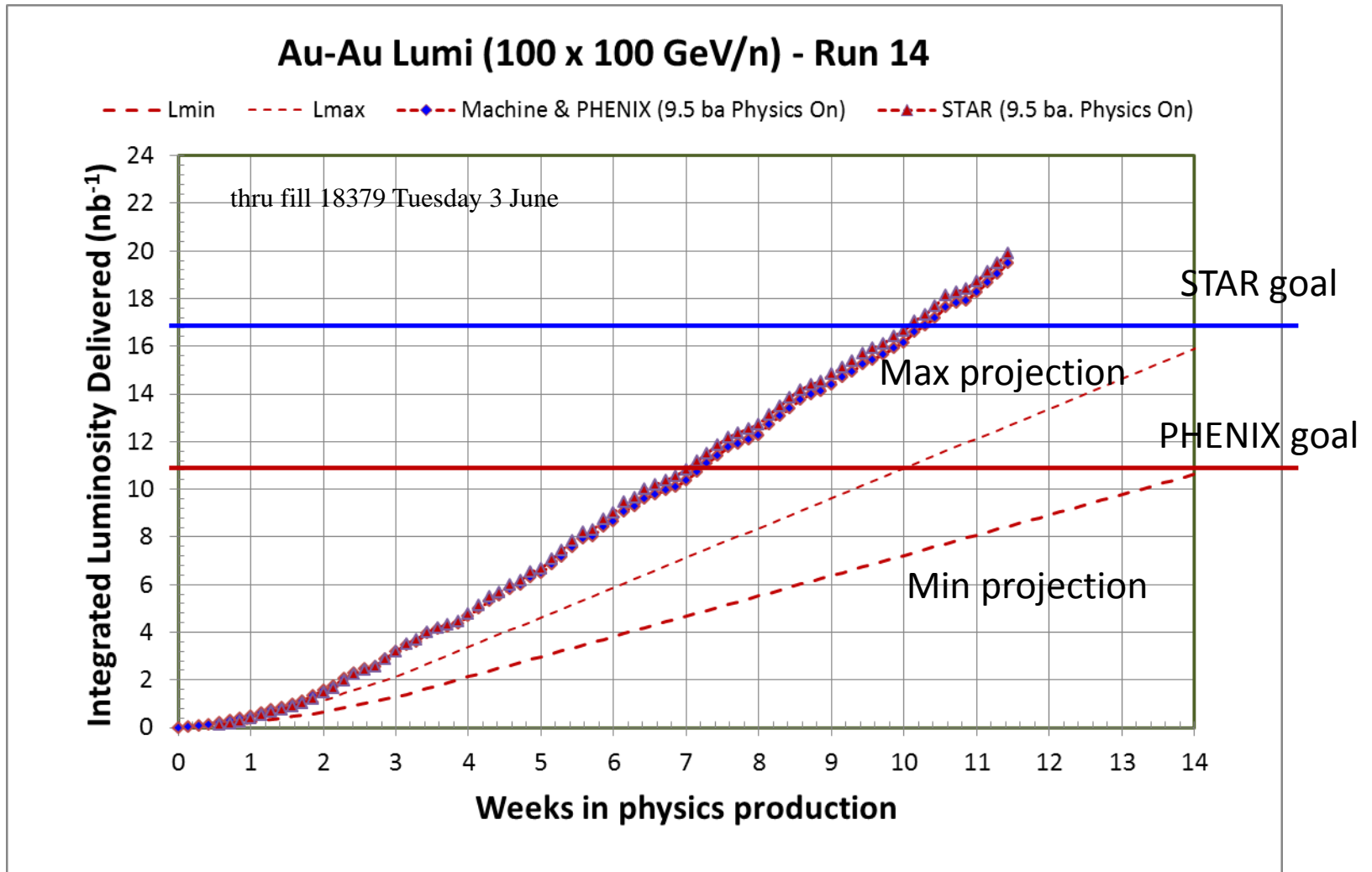
- ✓ 3 Feb, Begin cool-down to 4.5K
- ✓ 4 Feb, Cool-down to 6K in Blue
- ✓ 7 Feb, Blue and Yellow at 4.5 deg K
- ✓ 10-Feb, Beam in Blue and Yellow at injection
- ✓ 15-Feb, Begin  $\sqrt{s} = 14.6$  GeV/n AuAu physics
- ✓ ~~8-10~~ 11 Mar (Tuesday, 0800), End  $\sqrt{s} = 14.6$  GeV/n AuAu physics run begin setup for  $\sqrt{s} = 200$  GeV/n AuAu
- ✓ 15-Mar (~14:00, store 18046), Begin  $\sqrt{s} = 200$  GeV/n AuAu physics run
  - ✓ PHENIX 1<sup>st</sup> physics store = 18046 (15 March)
  - ✓ STAR 1<sup>st</sup> physics store = 18064 (17 March)

today, 3 June...

- ~~27-16~~ Jun, end 13.3 week  $\sqrt{s} = 200$  GeV/n AuAu run(assumes continued good stores)
- 16-June begin setup for  $\sqrt{s} = 200$  GeV/n  $^3\text{HeAu}$  run
- 7-July, end 3 week  $\sqrt{s} = 200$  GeV/n  $^3\text{HeAu}$  run (end sooner if  $^3\text{HeAu}$  goals met)
- ~~4-7~~ July, begin cryo warm-up
- ~~7-10~~ July, warm-up complete, ~~22.0~~ 22.4 cryo weeks of operation

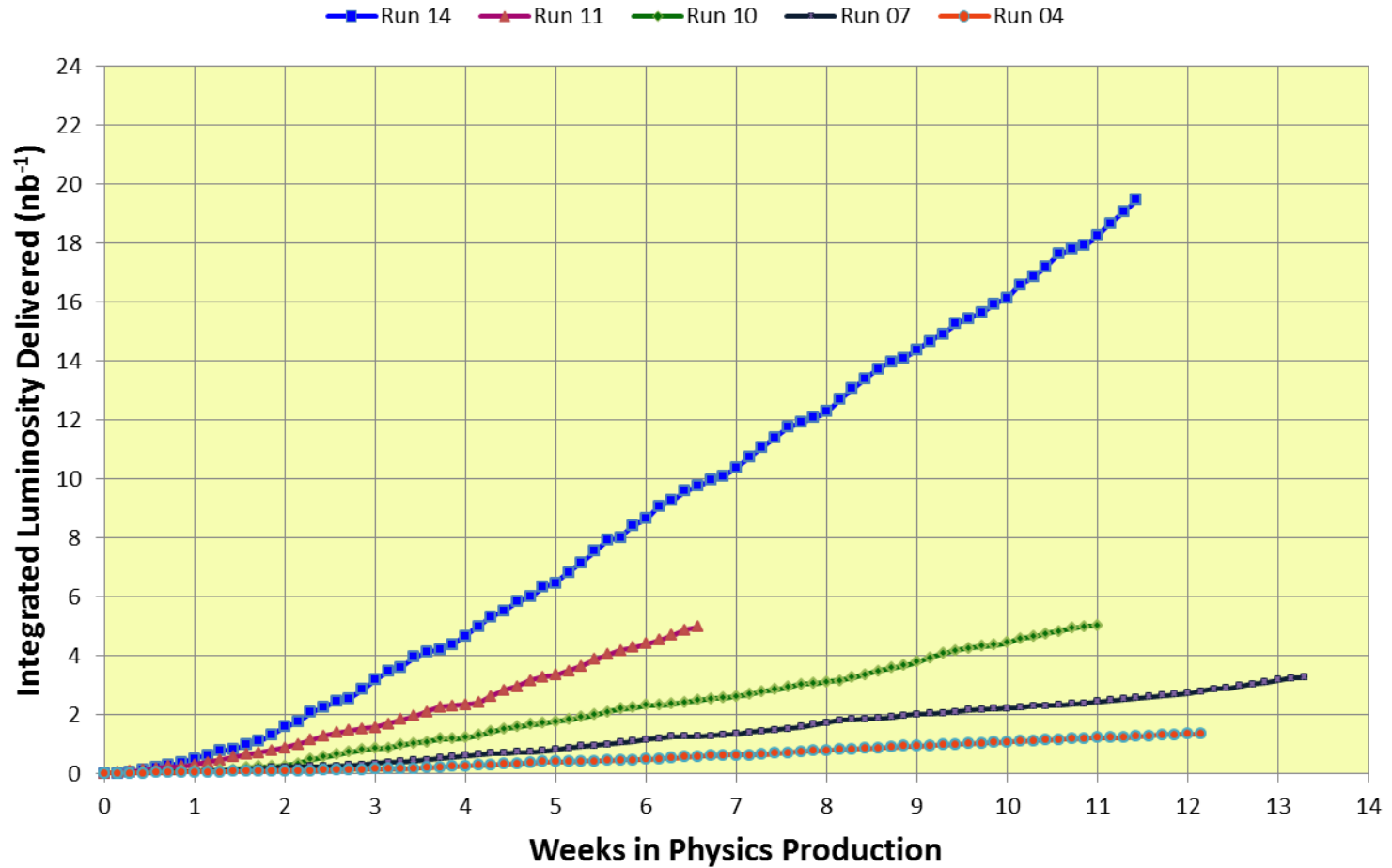
See <http://www.rhichome.bnl.gov/AP/RHIC2014/> for the Run Coordinator's detailed plan

*We should have updated goals!*

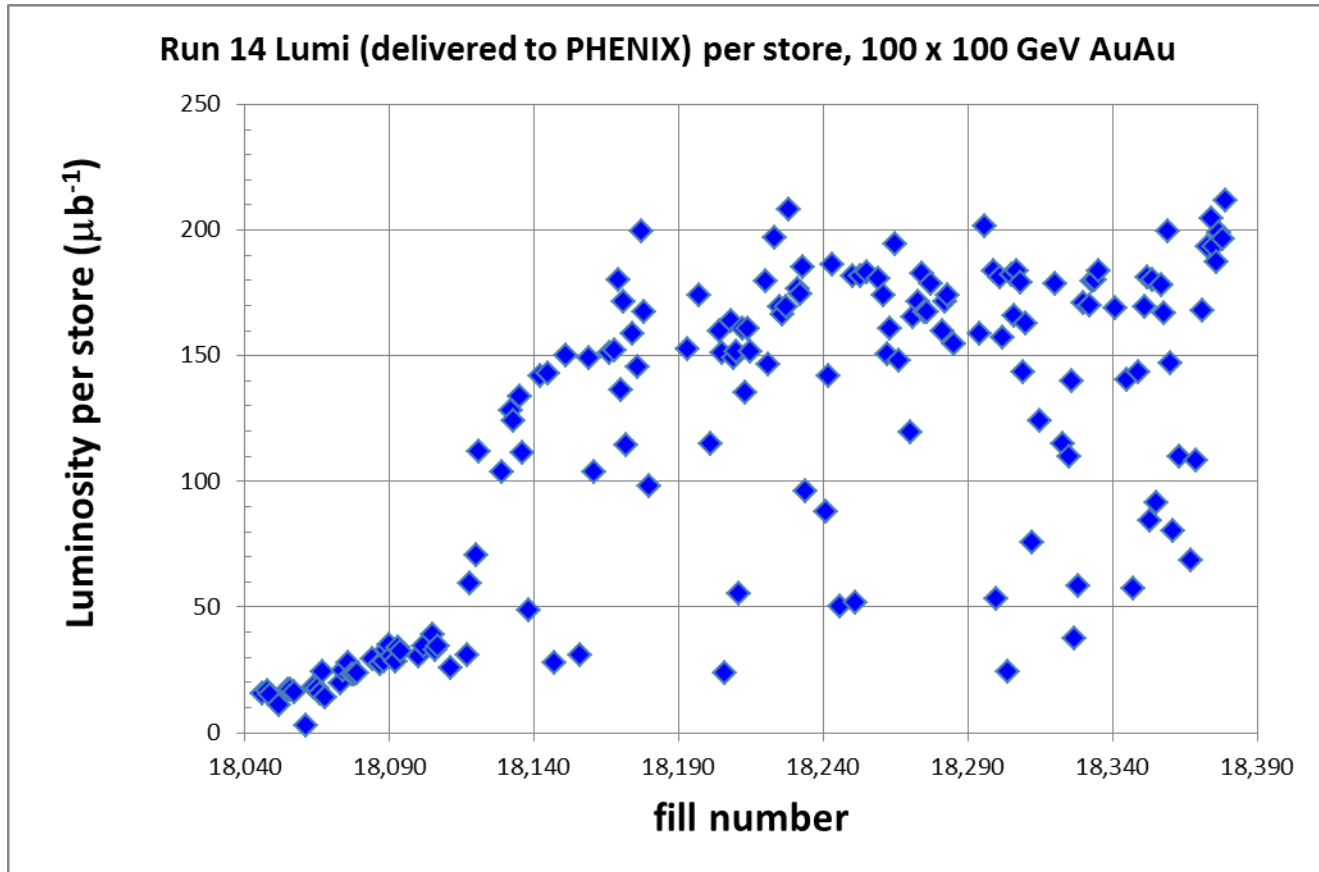


Through store 18379 Tuesday 3 June 14

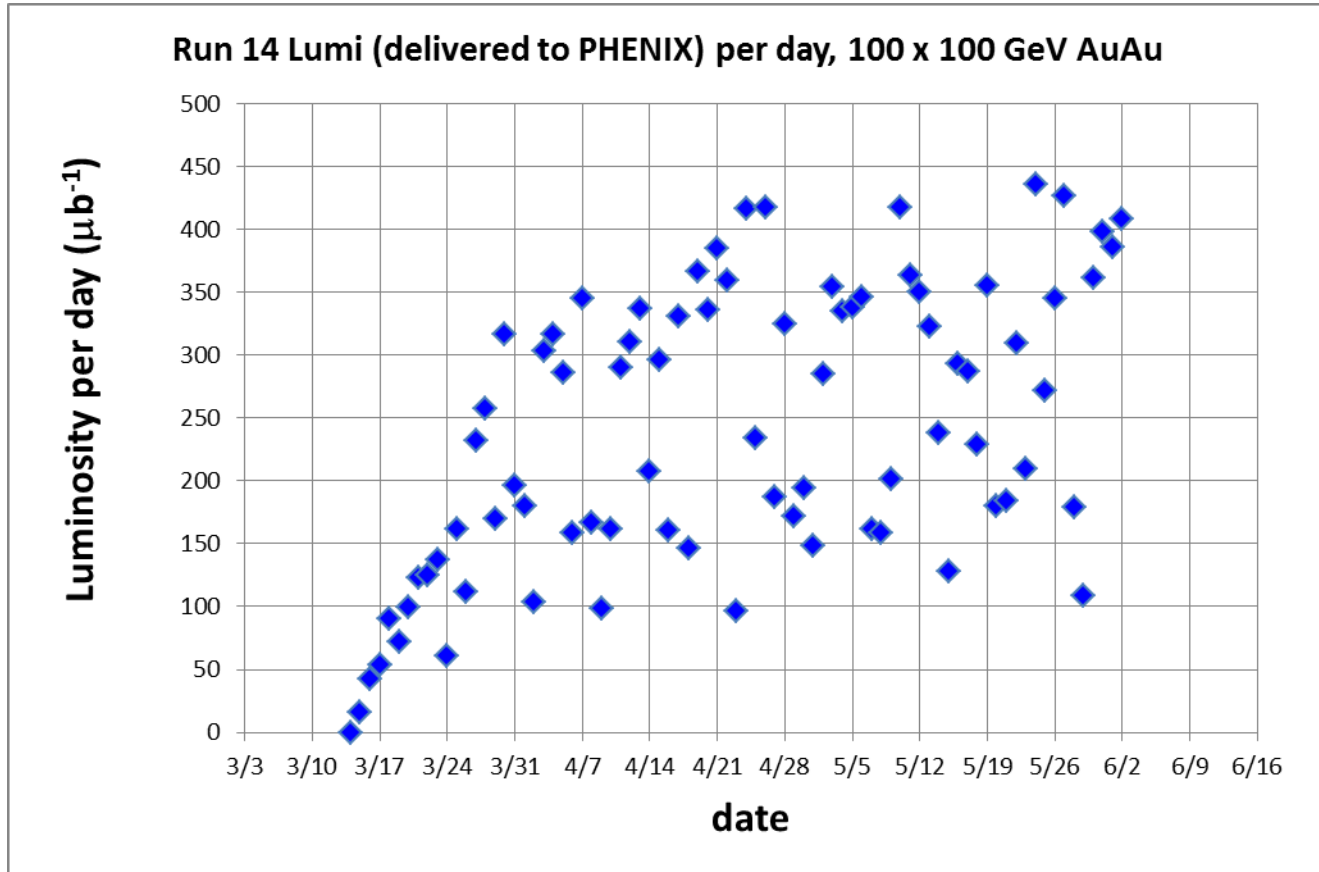
## Au-Au Lumi (100 x 100 GeV/n) - Run 04-14



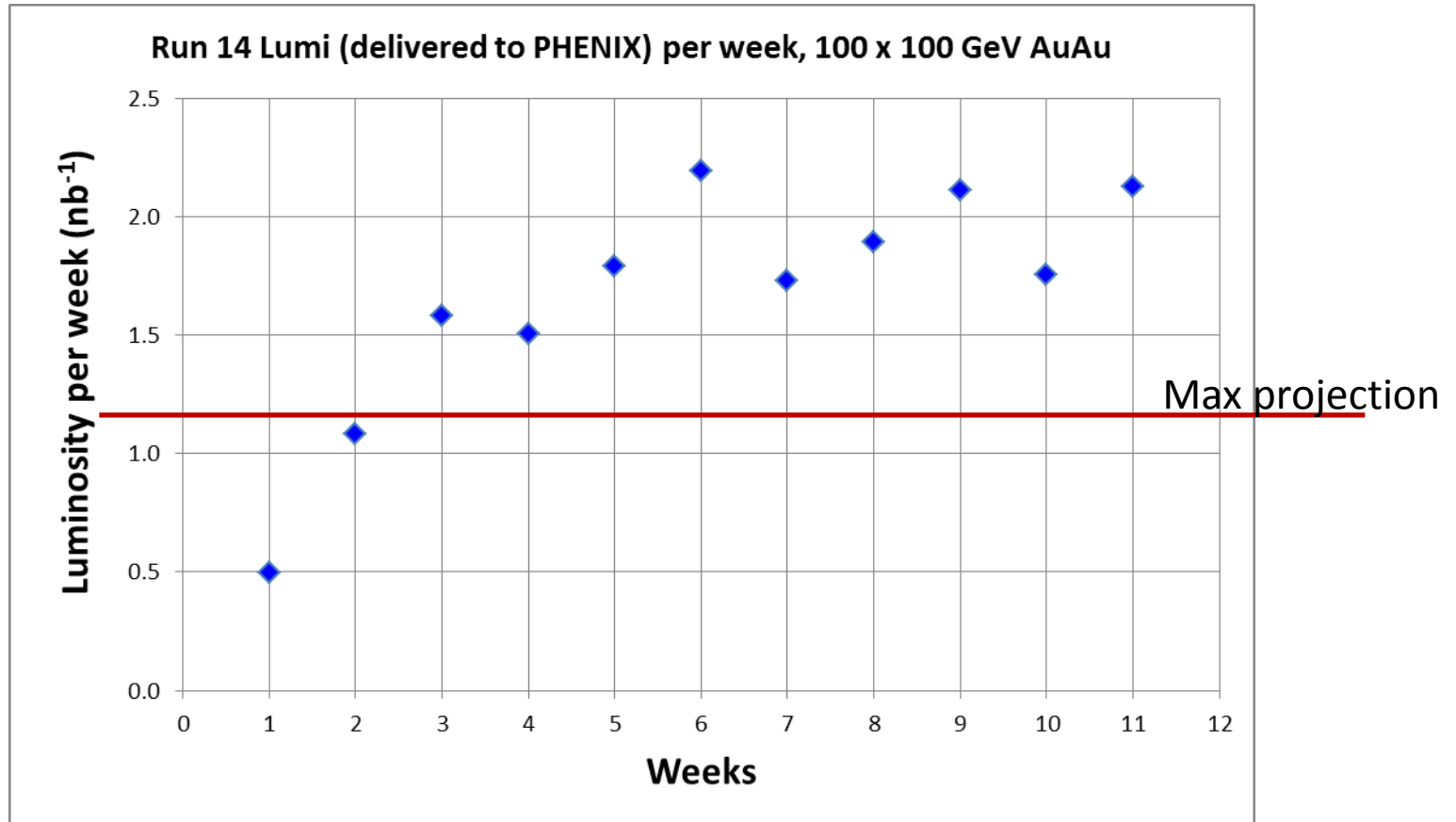
thru fill 18379 Tuesday 3 June



thru fill 18379 Tuesday 3 June

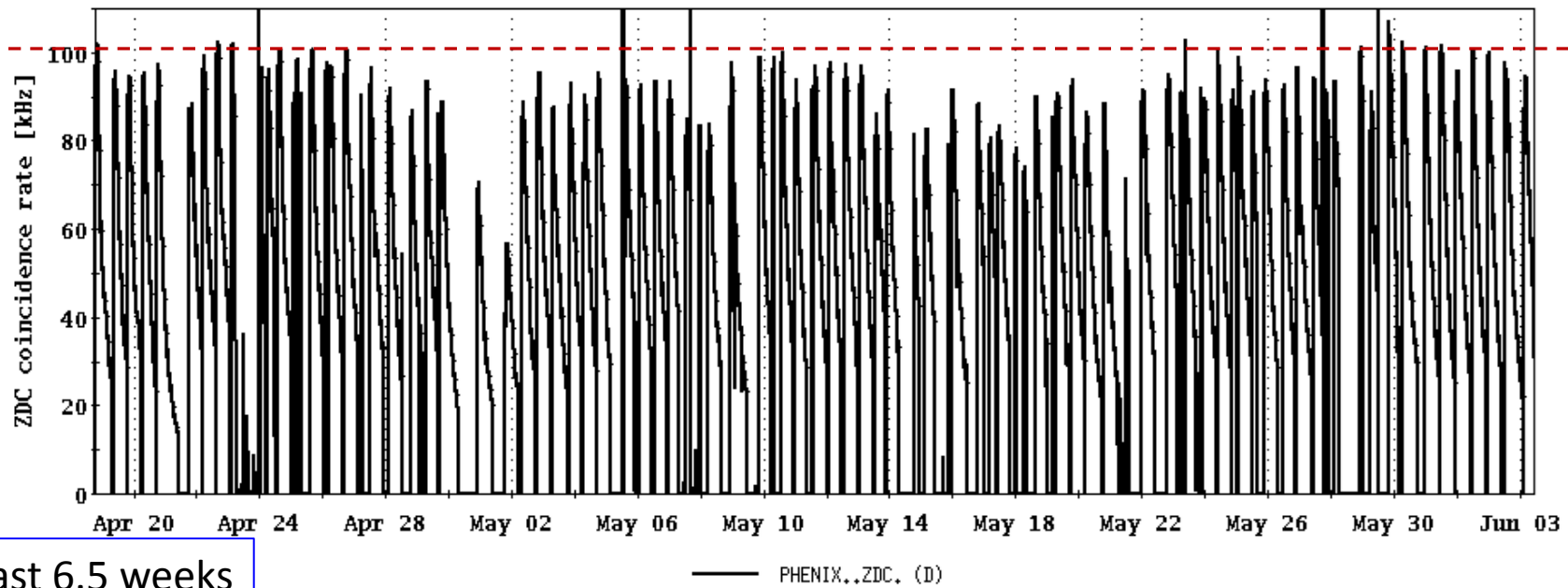


Through 30 May stores

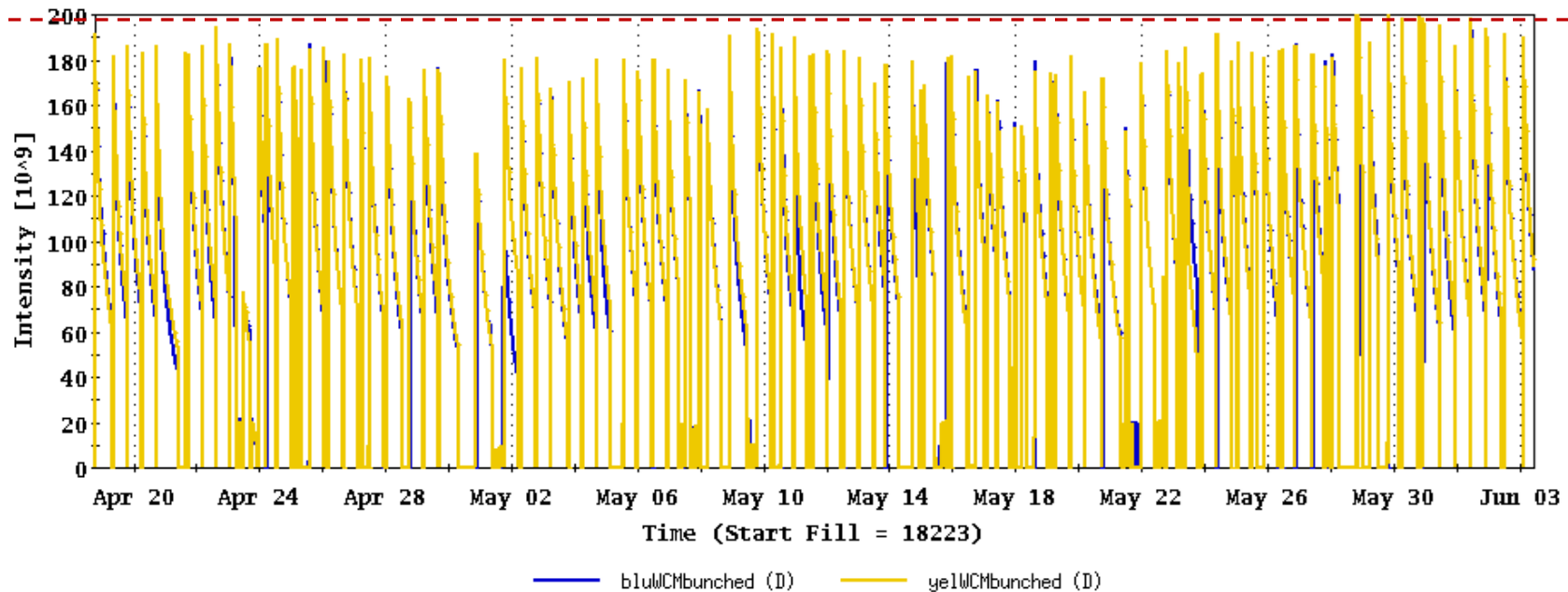


Experimental Coincidence Signals

Not corrected PHENIX ZDC

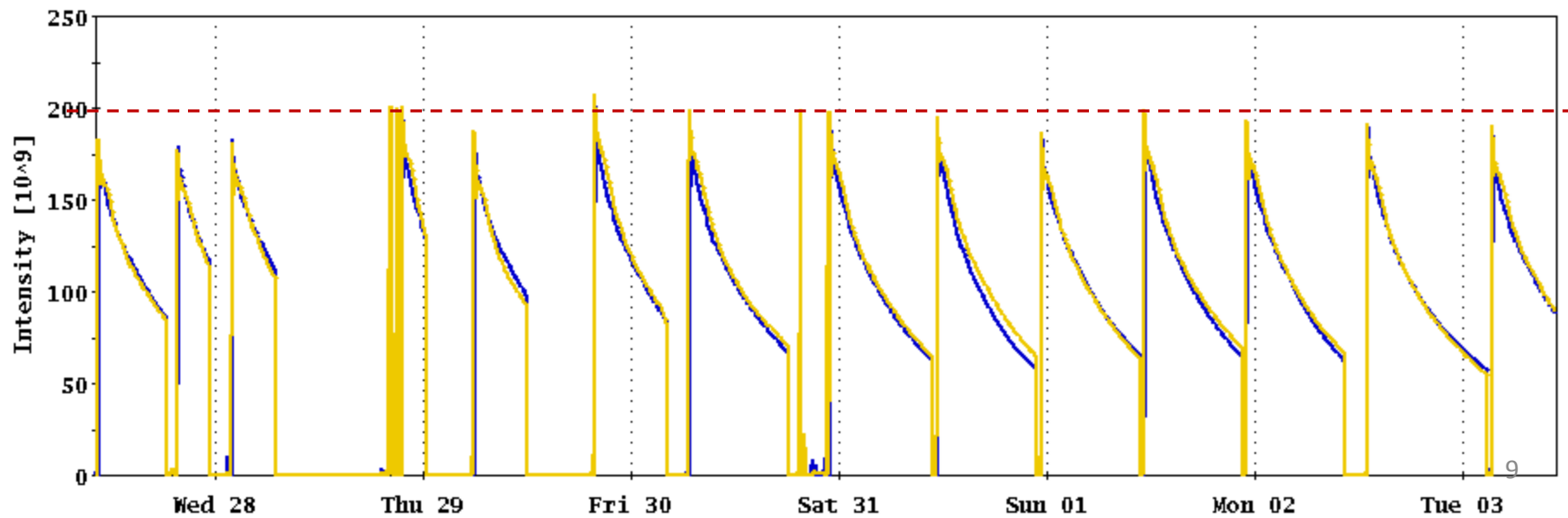
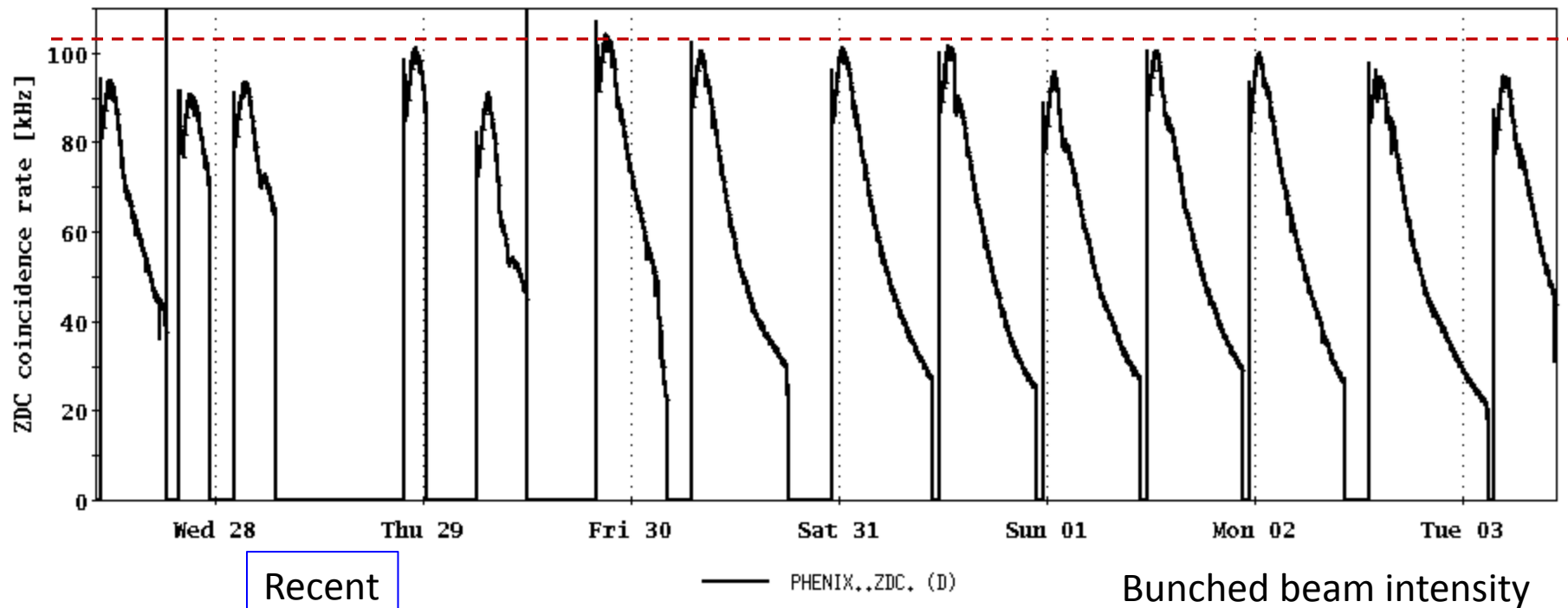


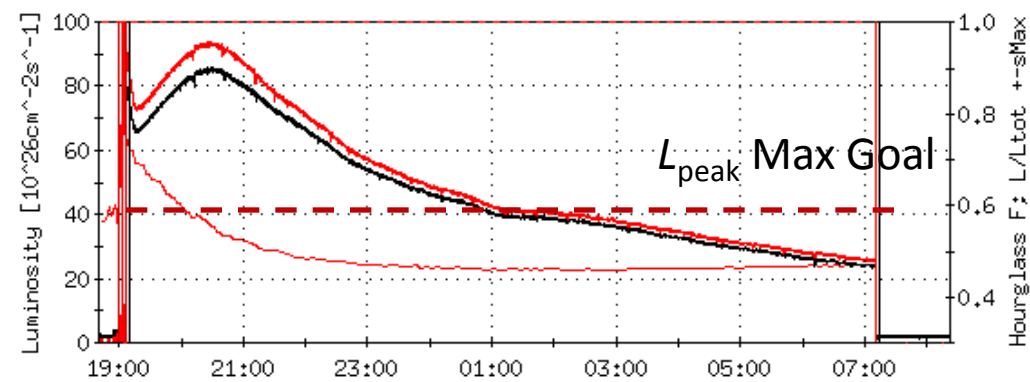
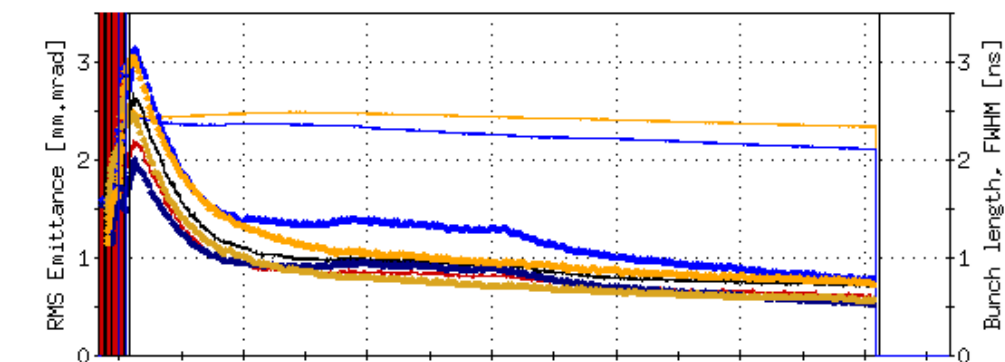
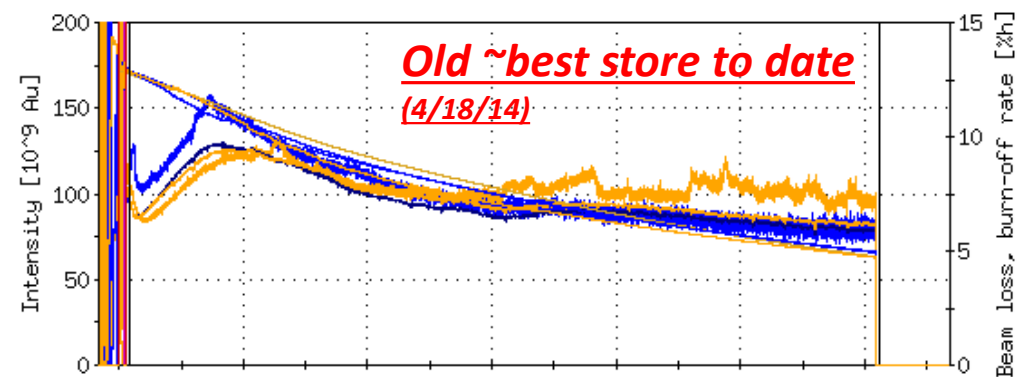
Bunched beam intensity



Experimental Coincidence Signals

Not corrected PHENIX ZDC





Fill   Species

Run

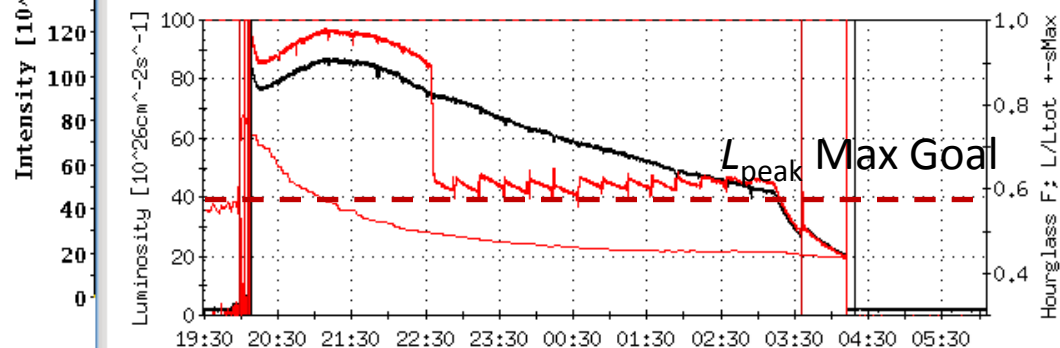
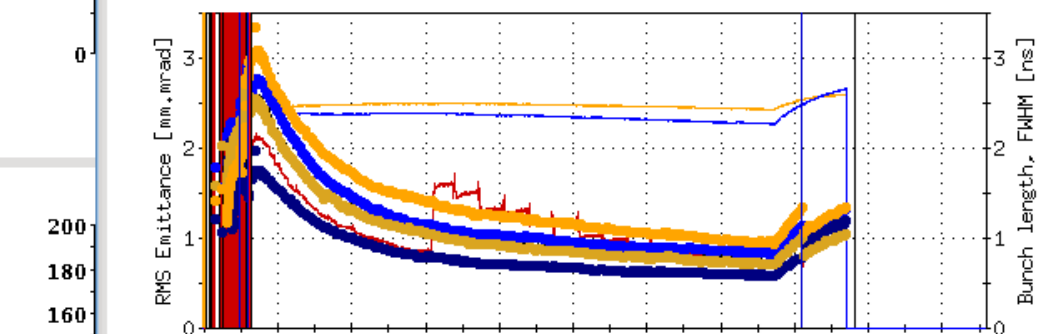
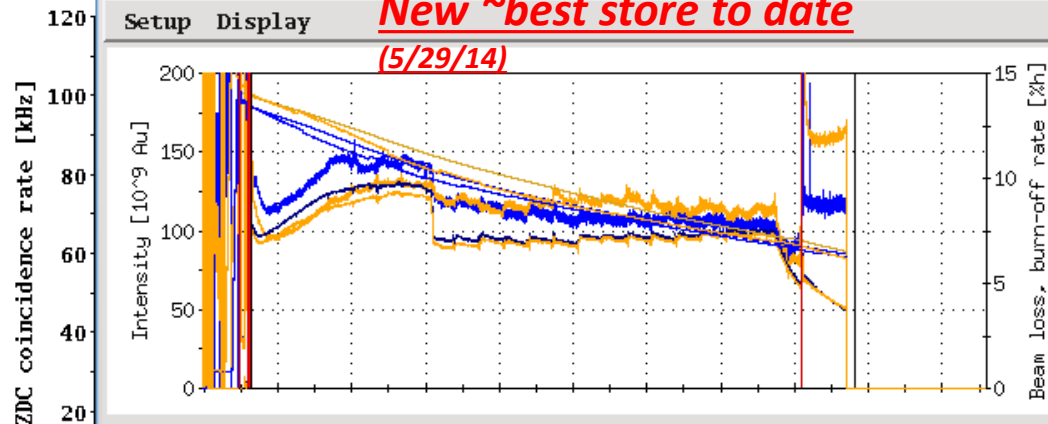
Beam Parameters

Pattern  gamma

Parameters

	PHENIX	STAR
Number collisions	<input type="text" value="111"/>	<input type="text" value="102"/>
beta* [m]	<input type="text" value="0.70"/>	<input type="text" value="0.70"/>
sMax [m]	<input type="text" value="10.00"/>	<input type="text" value="10.00"/>
sigma [b]	<input type="text" value="9.900"/>	<input type="text" value="9.500"/>

Single Correction

**New ~best store to date****(5/29/14)**

```
sisScaler.8c-phenix.16:diffM:valueAndTime = 86.8298
Time = Thu May 29 21:11:55 2014+4ms,
sisScaler.6a-star.16:diffM:valueAndTime = 96.3425
```

Fill **18371** Update Species AuAu

Run run\_fy14

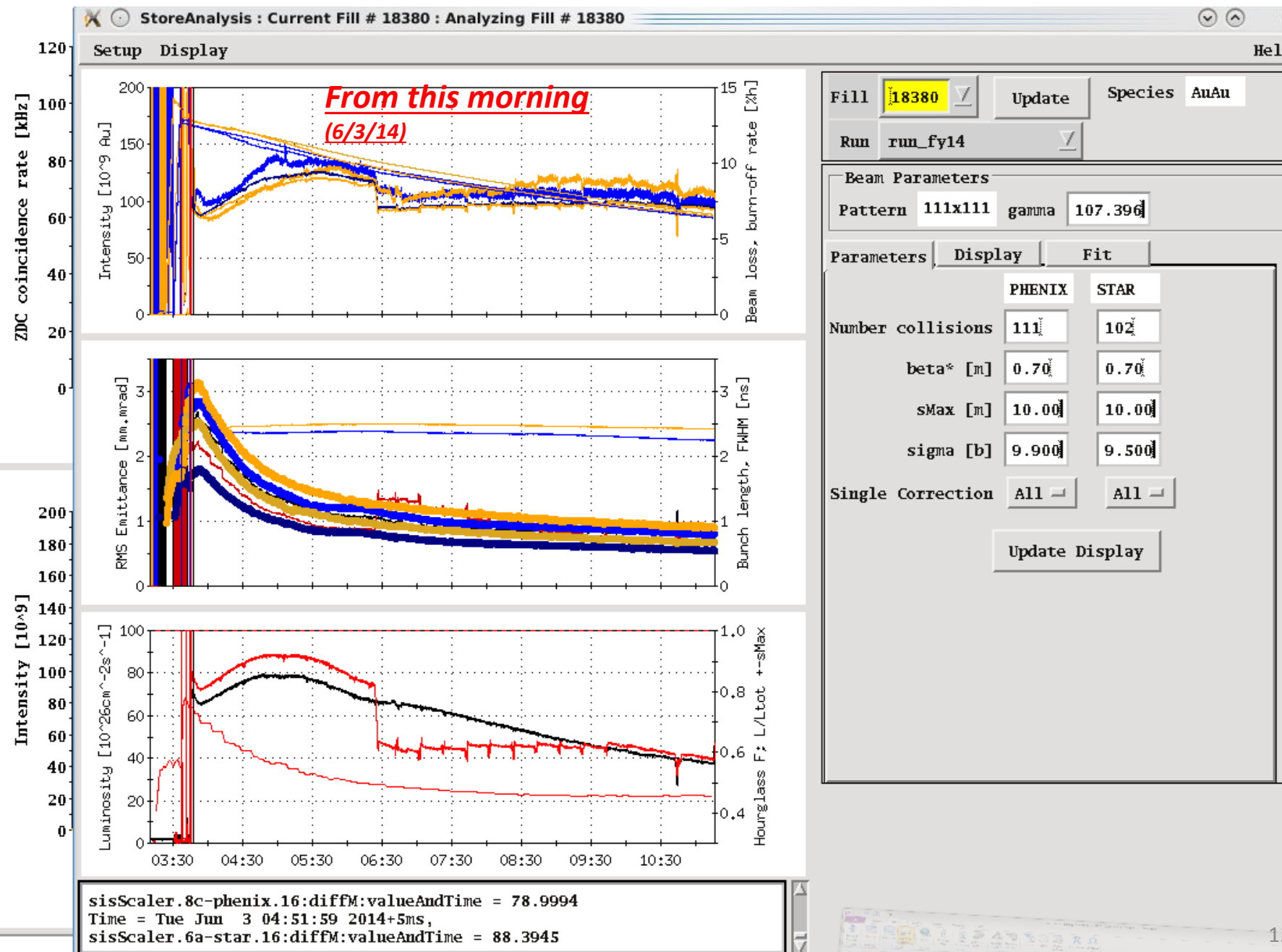
Beam Parameters

Pattern 111x111 gamma 107.396

Parameters Display Fit

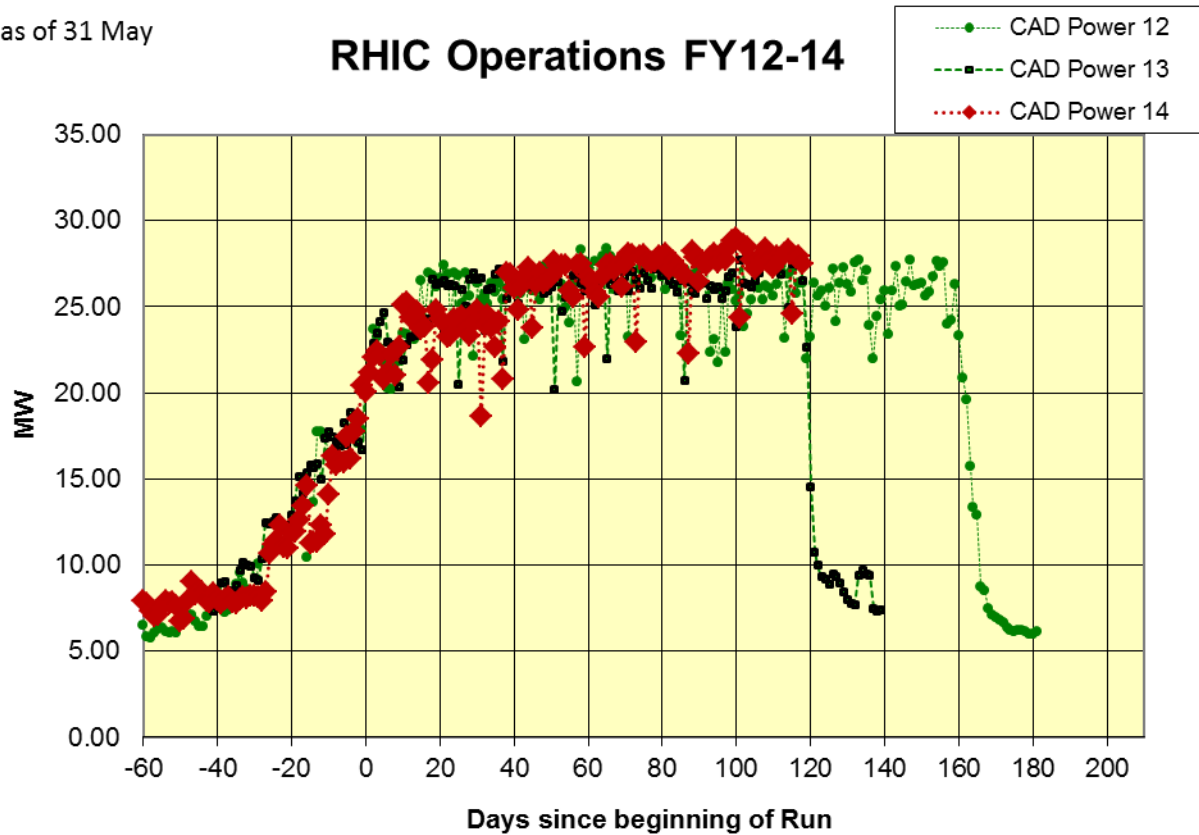
	PHENIX	STAR
Number collisions	111	102
beta* [m]	0.70	0.70
sMax [m]	10.00	10.00
sigma [b]	9.900	9.500
Single Correction	All	All

Update Display



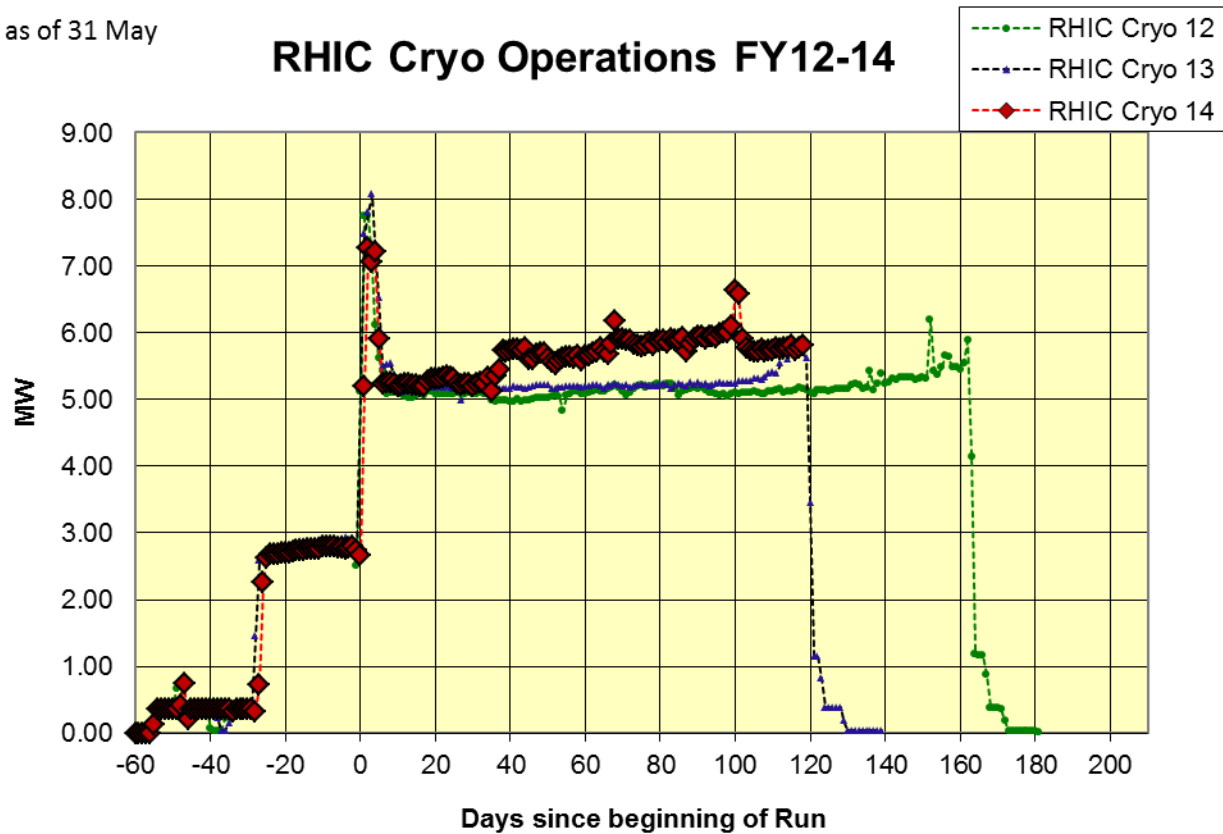
as of 31 May

## RHIC Operations FY12-14



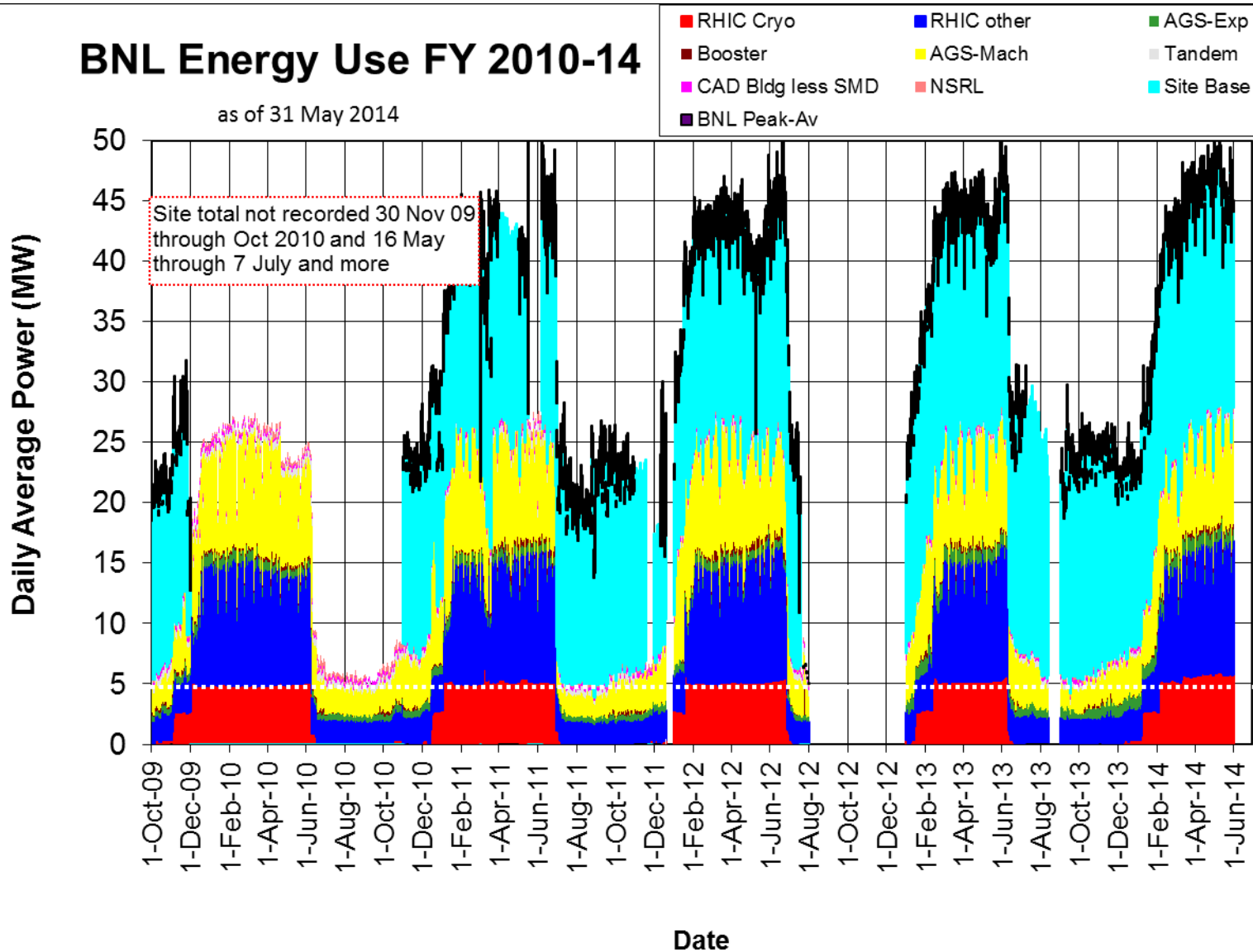
as of 31 May

## RHIC Cryo Operations FY12-14



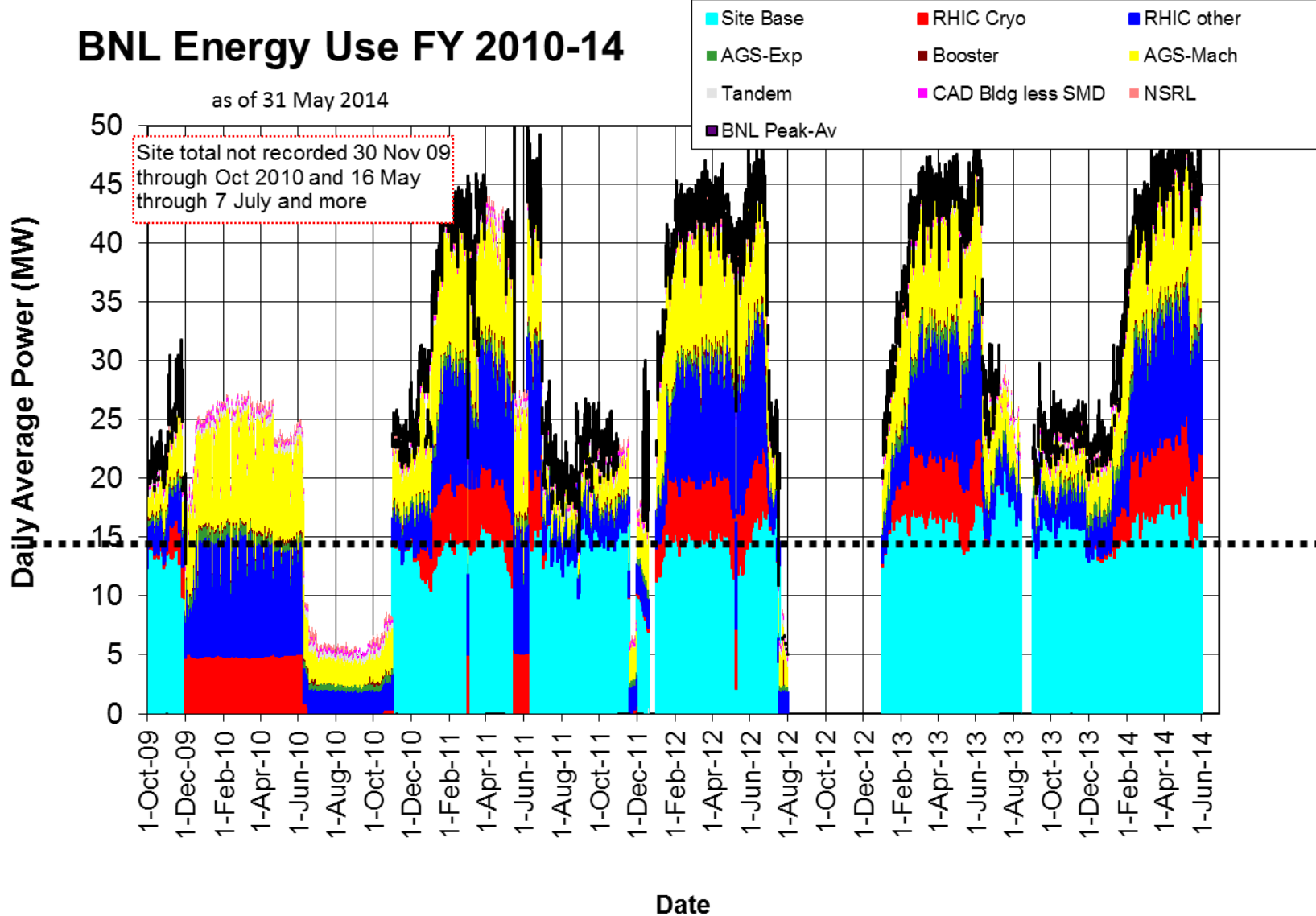
# BNL Energy Use FY 2010-14

as of 31 May 2014



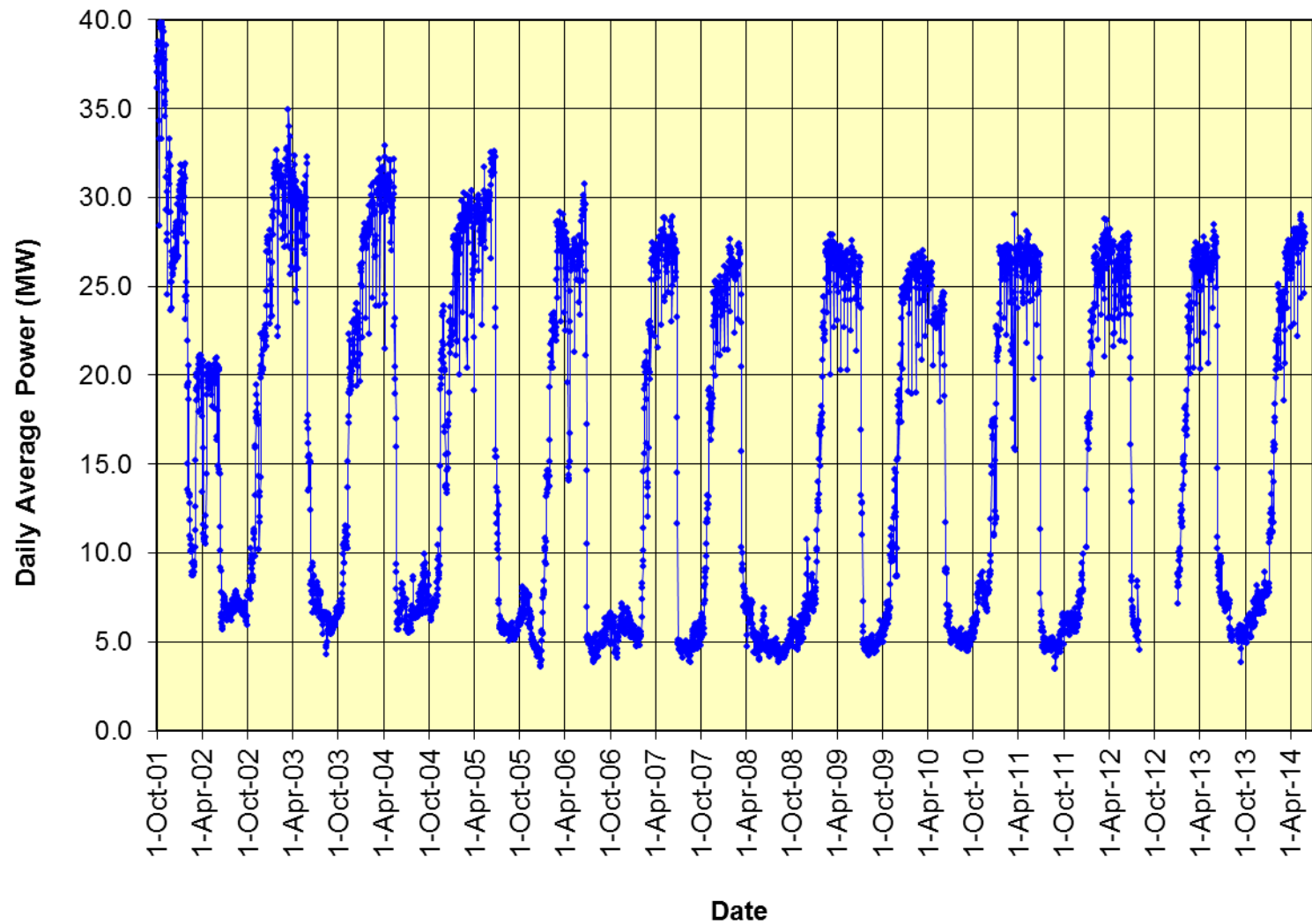
# BNL Energy Use FY 2010-14

as of 31 May 2014



as of 31 May 2014

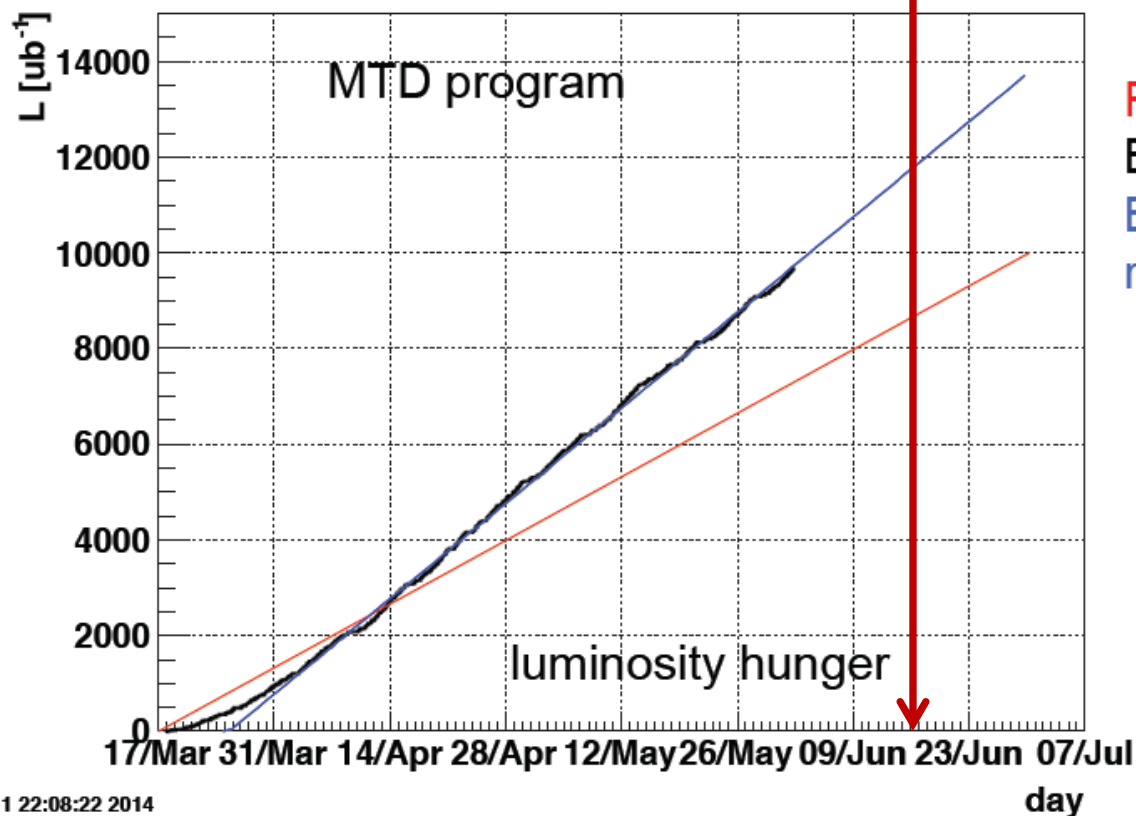
## C-AD Energy Use FY 2002-14



# **STAR – Slides from Time Meeting**

dimuon\_upsiloneff

16 June



Red: goal

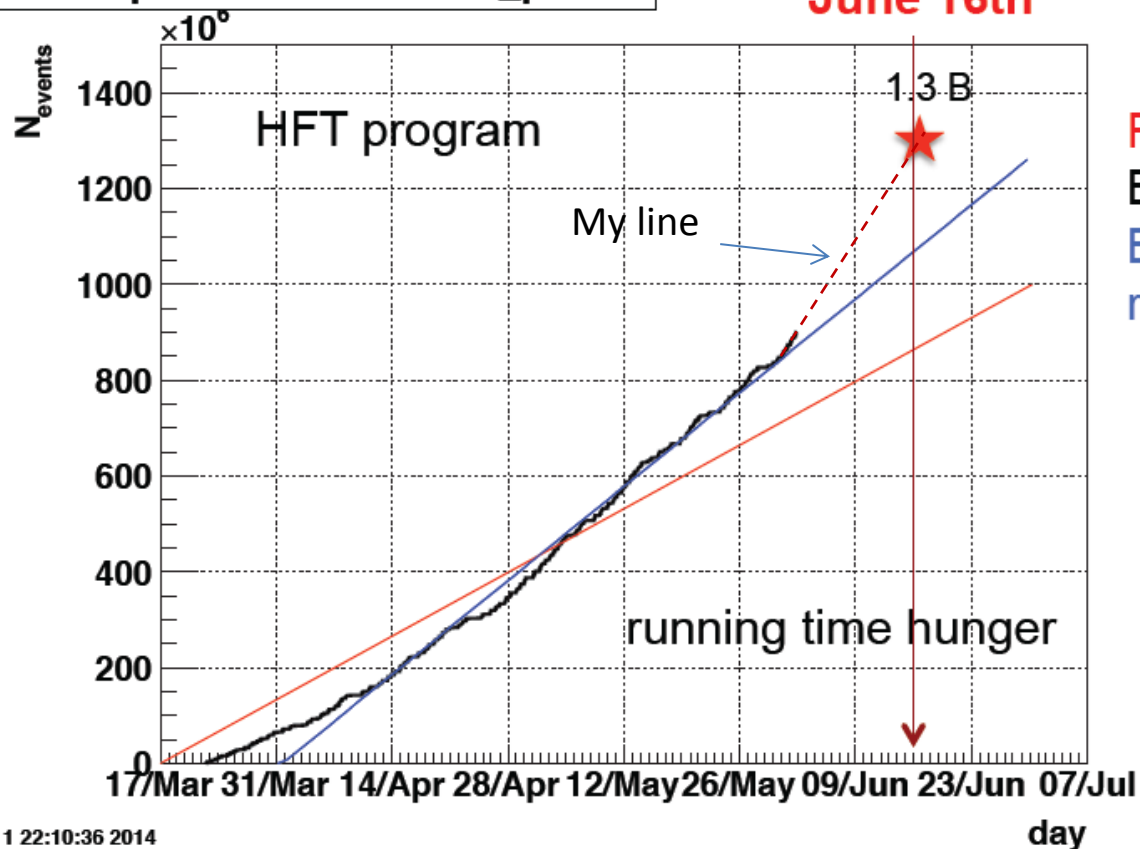
Black: STAR performance

Blue: projection based on recent ~6 weeks

Sun Jun 1 22:08:22 2014

Luminosity hunger trigger (MTD program) looks pretty good  
But always better with more statistics (Upsilon)!

VPDMB-5-p-nobsmd-effective\_pxlist



Red: goal

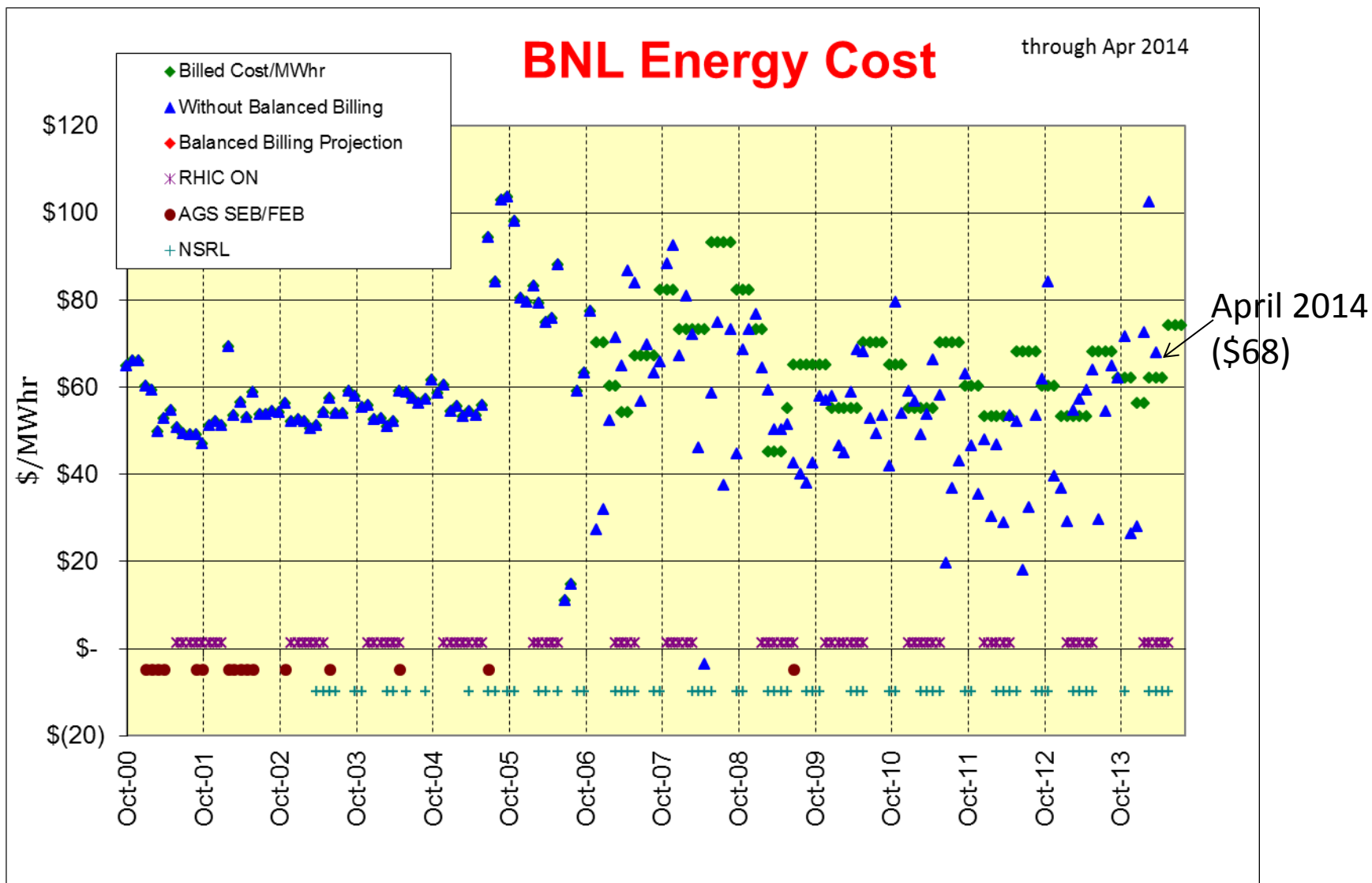
Black: STAR performance

Blue: projection based on recent ~6 weeks

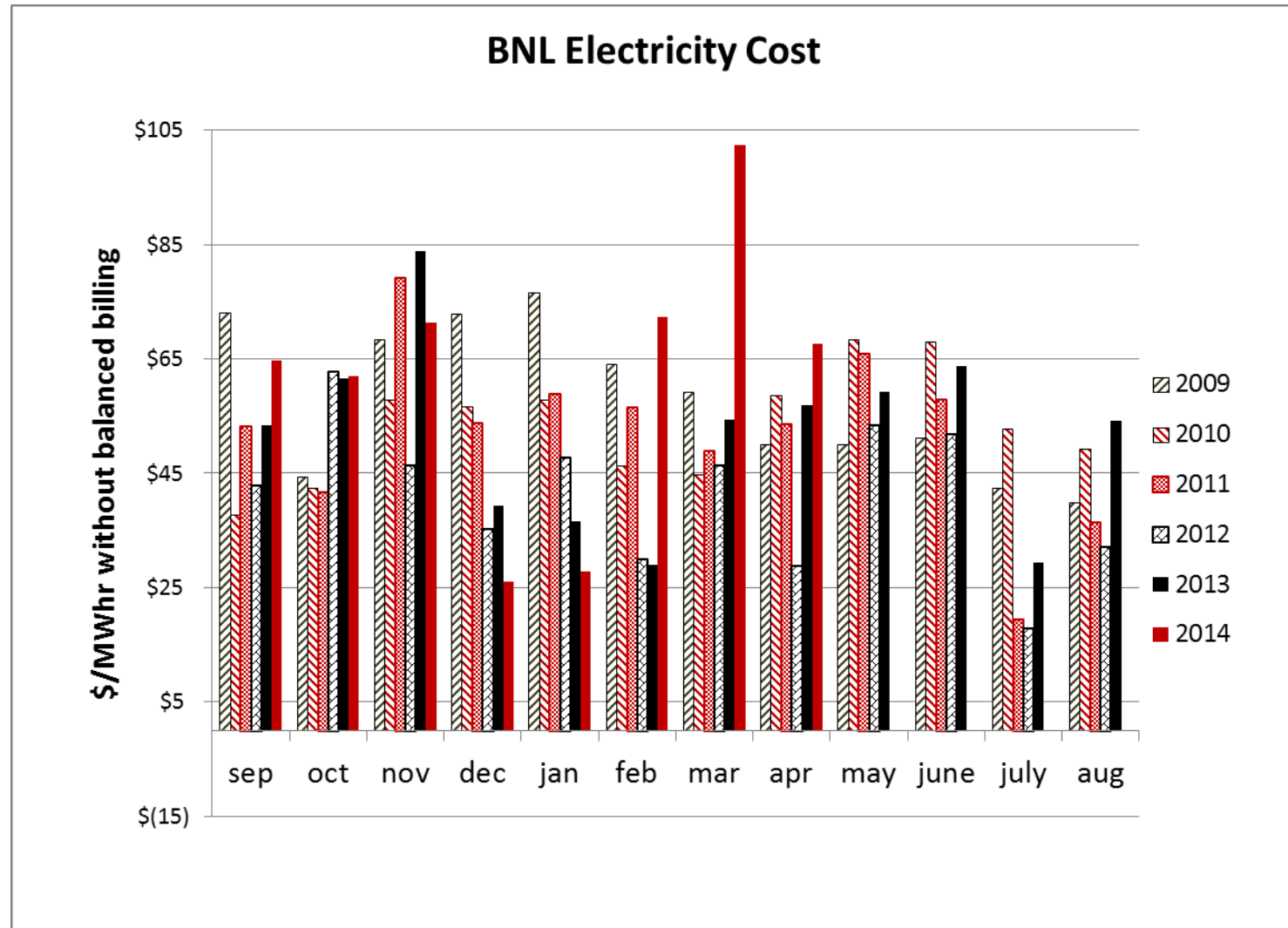
- Due to acceptance loss in PXL detector caused by beam radiation, we need ~30 % more events to have the same quality of physics result.
- Re-optimizing at STAR increases HFT data rate by ~ 8% per hour store
- We need more time at store for Au+Au@200GeV!

# Archive

FY 2014 power rebate \$ in BNL bank = **-\$0.865M (in the hole!)**, through April



Thru April 2014



## **STAR Proposal for optimum running**

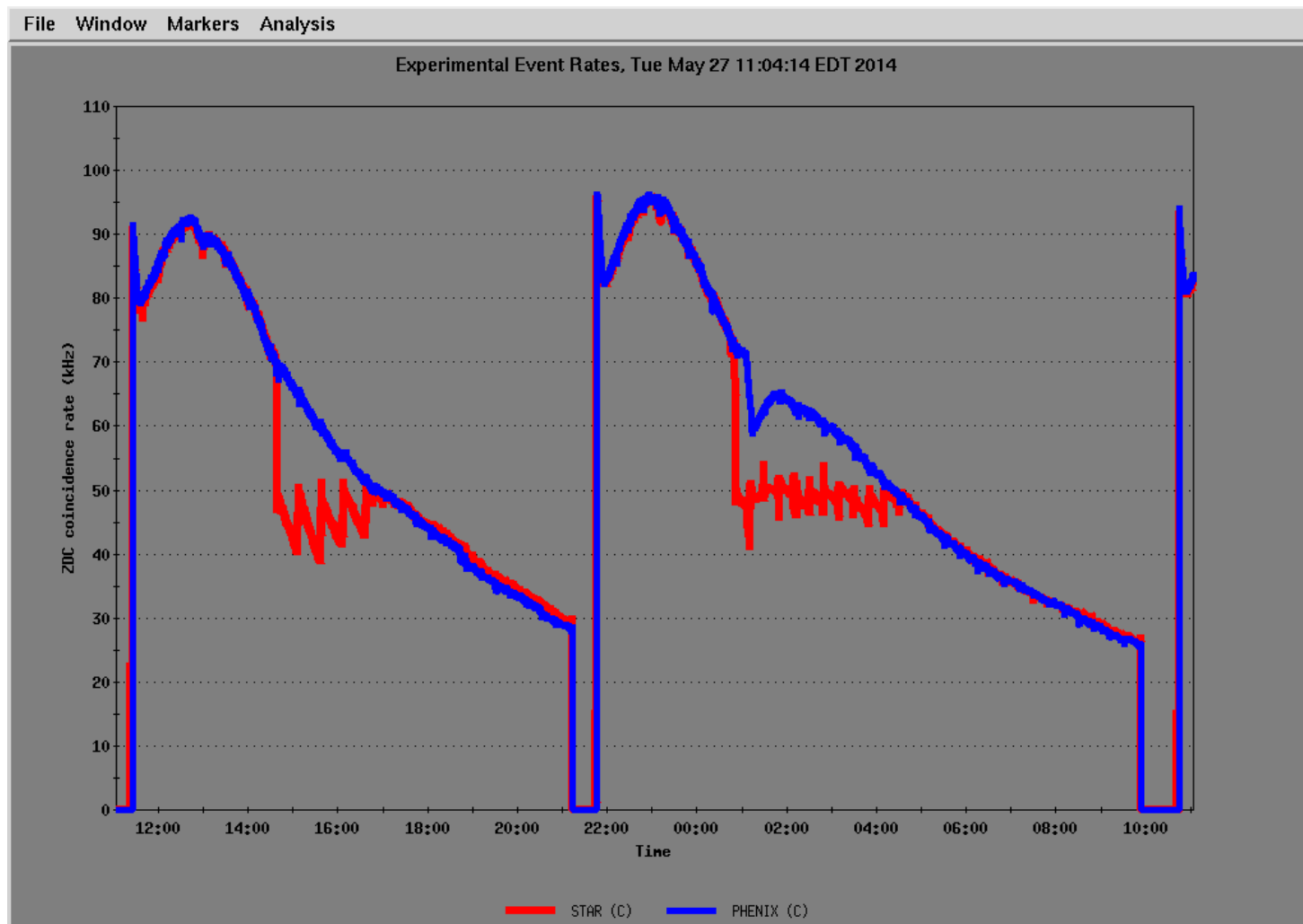
# Proposal for optimizing RHIC Running between now and switch to He3- Au

RHIC Coordination mtg.

May 27, 2014

Bill Christie

For the STAR Collaboration






# Proposal:

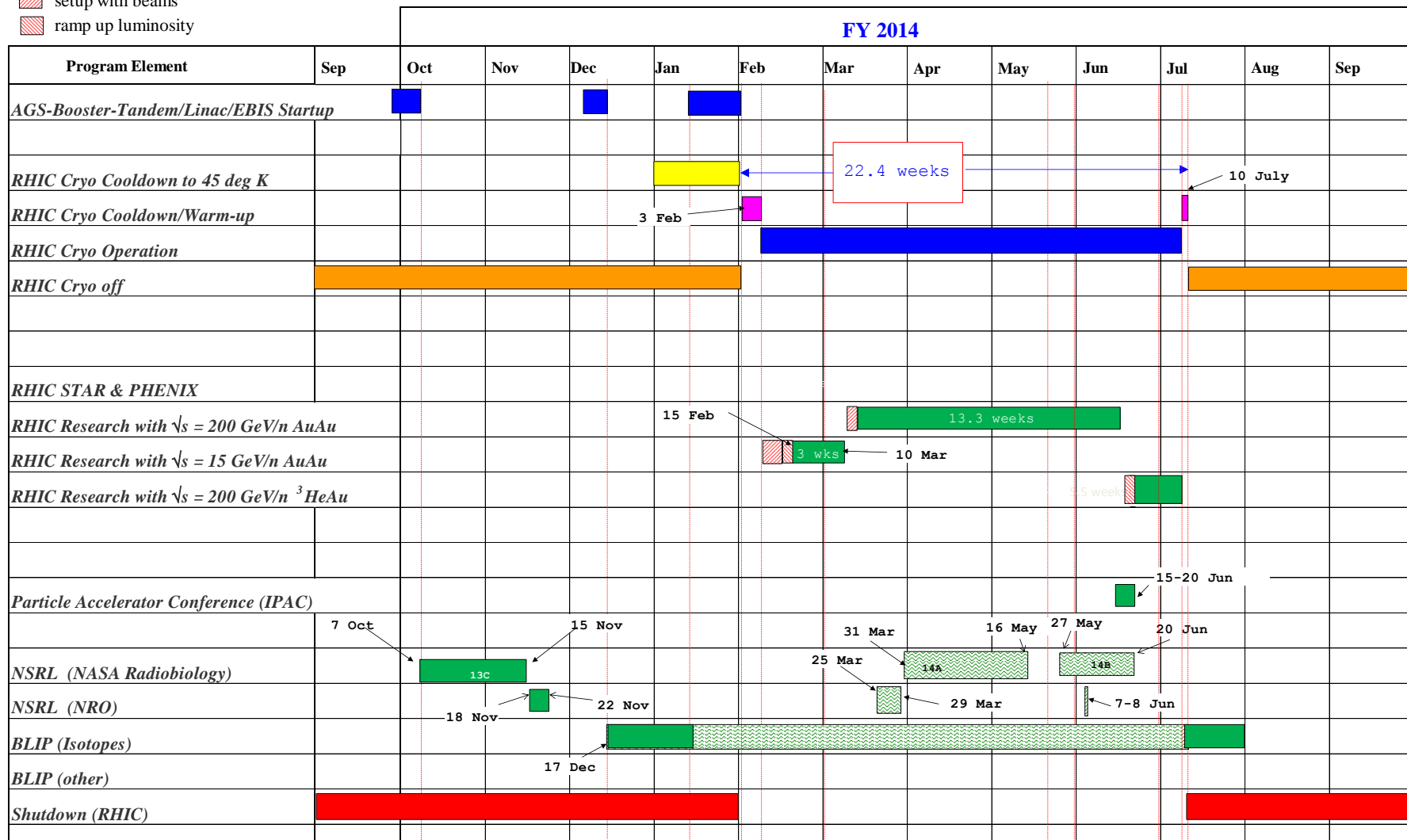
- 1.) Drop the collision rate in STAR down to 50 kHz 2.5 hours into the store, as opposed the current mode where it's dropped after 3 hours.
- 2.) Extend the store length from 10 hours to 11 hours.
- 3.) Minimize Machine Development time between now and the switchover to He3-Au running.
- 4.) Consider dropping one APEX session between now and the switchover to He3-Au running.
- 5.) Investigate implementing the dynamic Beta squeeze (aka THOR) at STAR late in the store when the 50 kHz rate can't be maintained.
- 6.) Consider gains in the luminosity lifetime that could result from either mis steering PHENIX or increasing the PHENIX beta\*.
- 7.) Depending on how far we get in reaching STAR's goal's, reconsider the He3-Au switch over date.

# C-A Operations-FY14

20 May 14

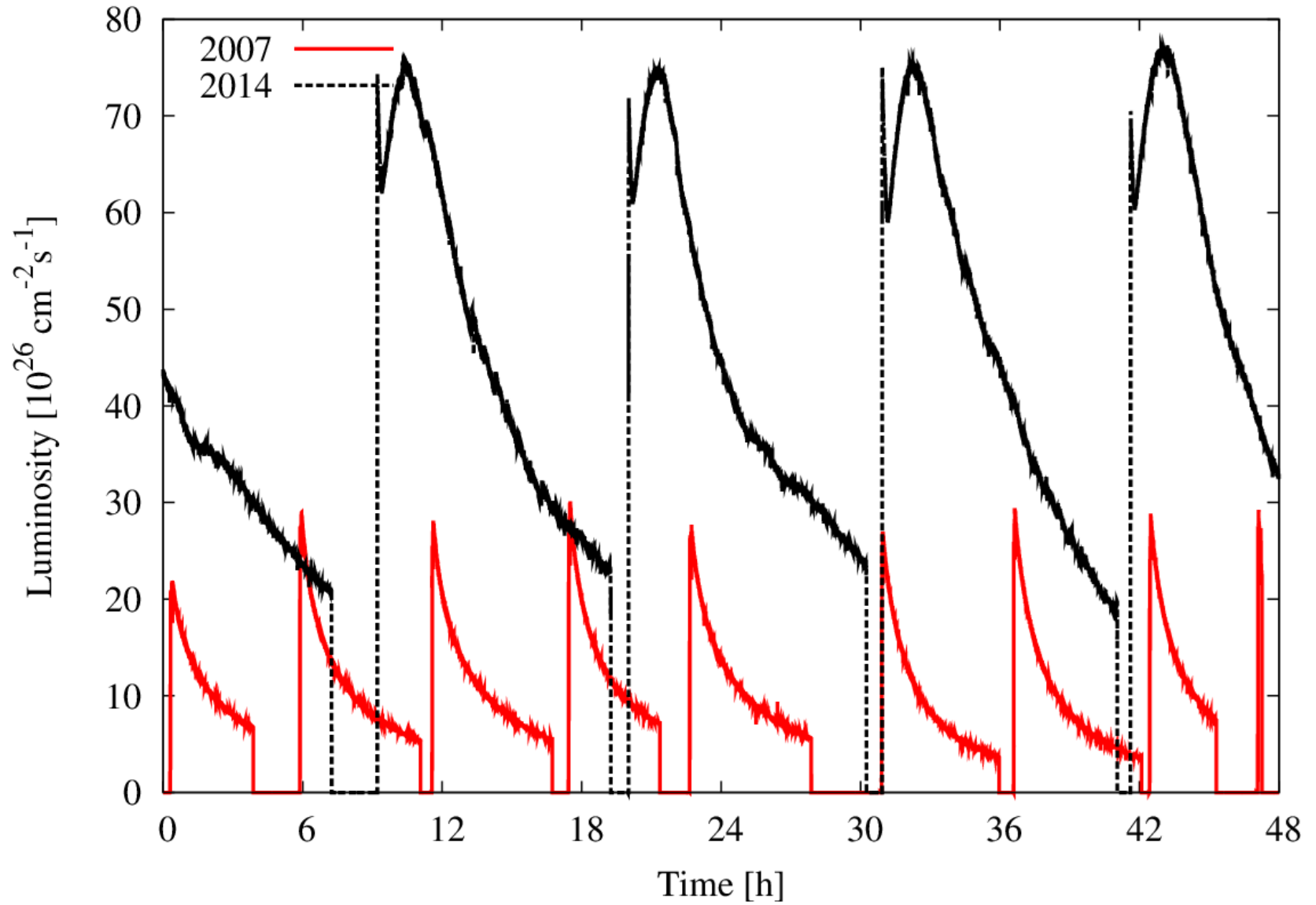
-  concurrent with RHIC
-  setup with beams
-  ramp up luminosity

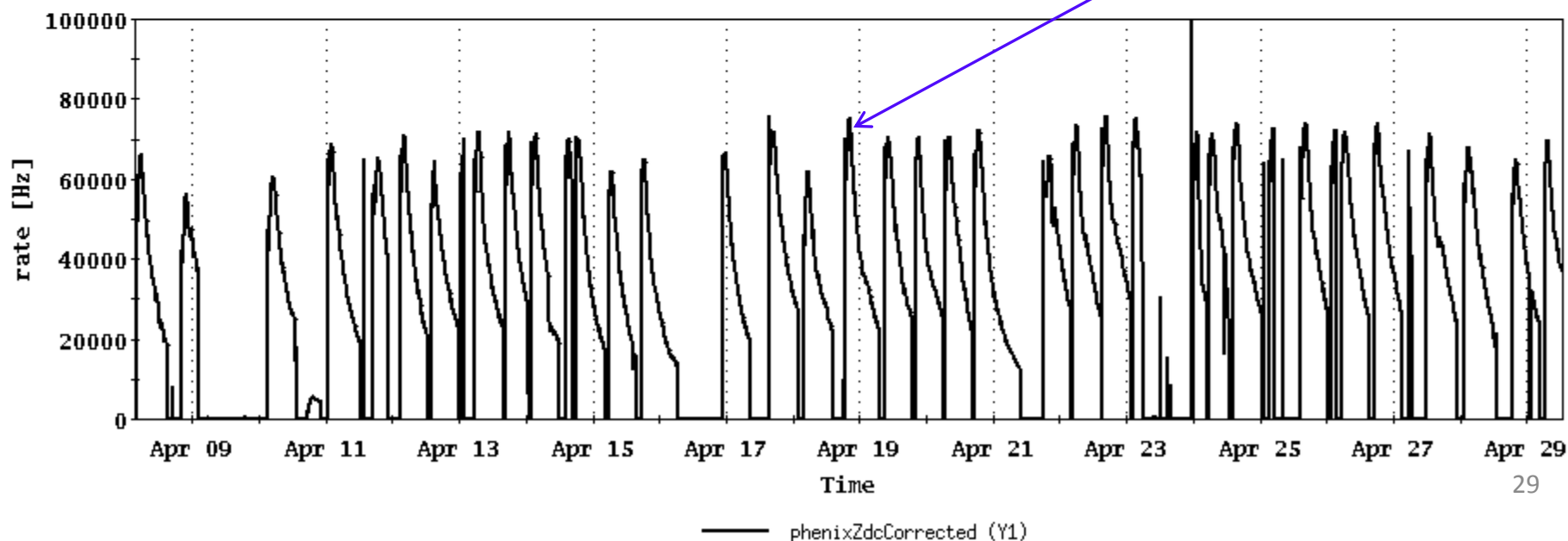
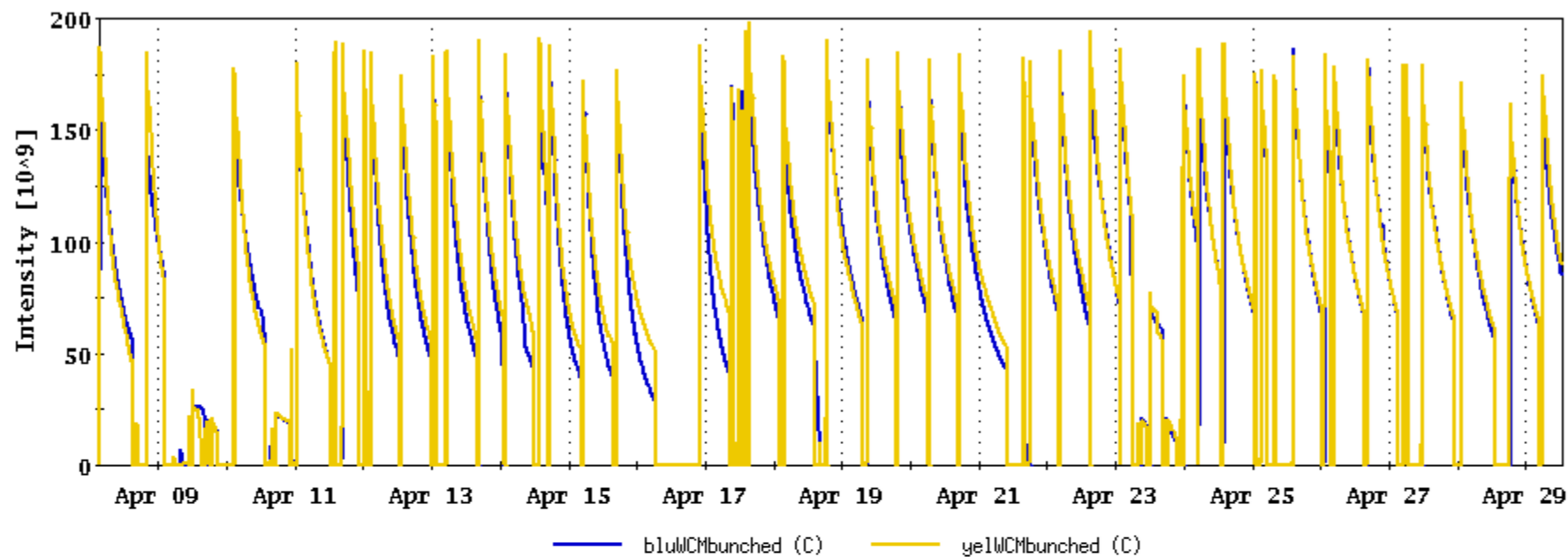
*planned, budget permitting*

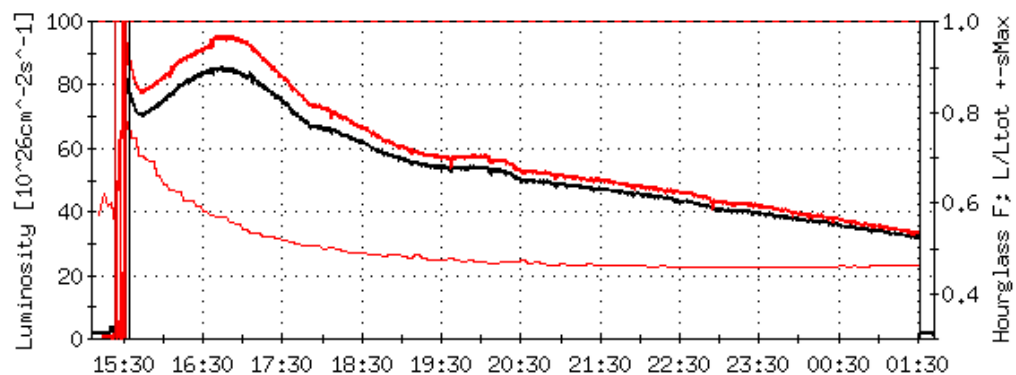
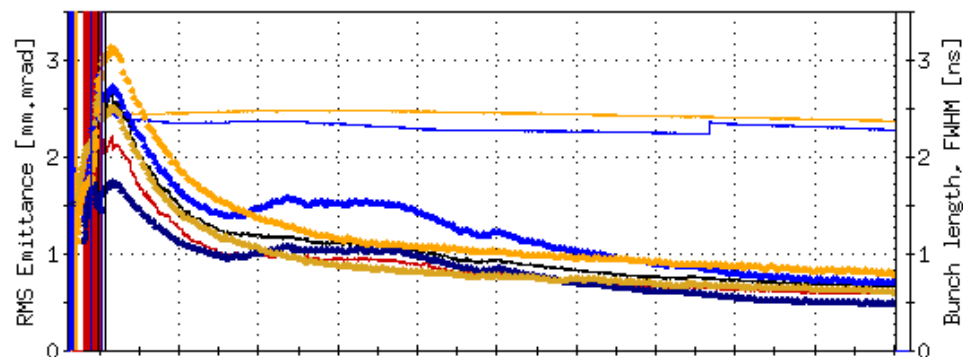
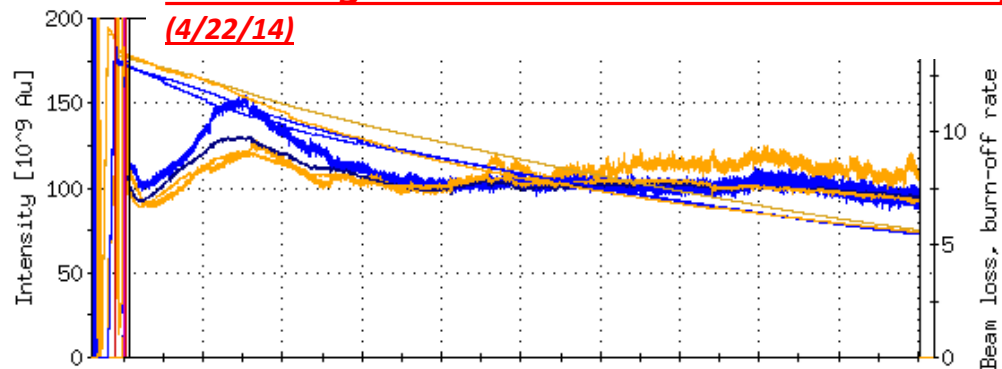


From Wolfram, 5/6/2014

## RHIC-II





**Another good store – a lot more about as good!****(4/22/14)**

1   Species AuAu

Run

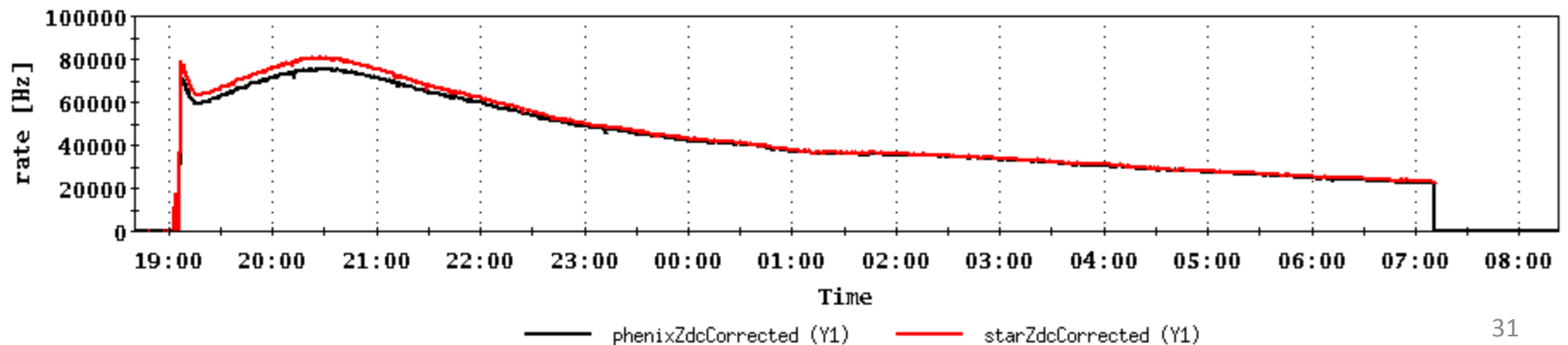
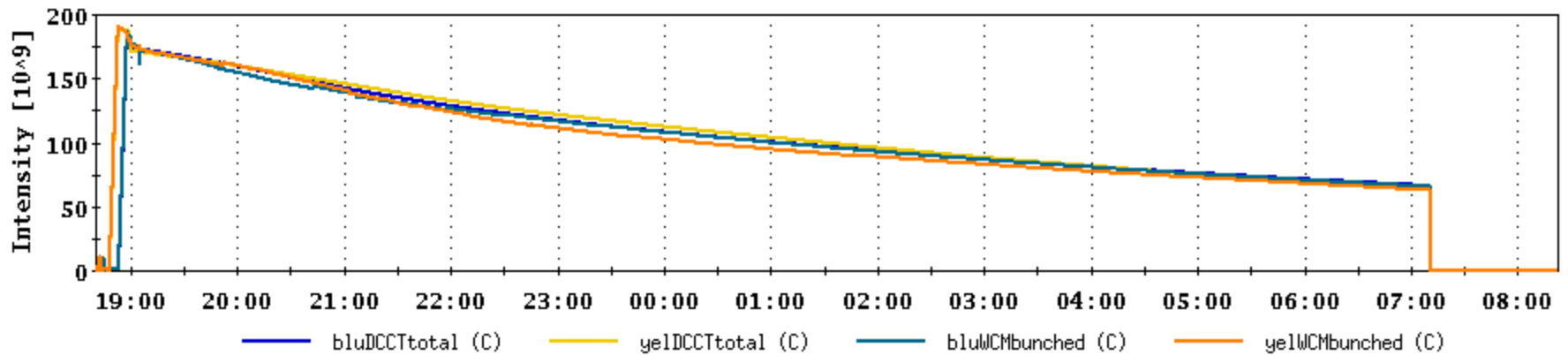
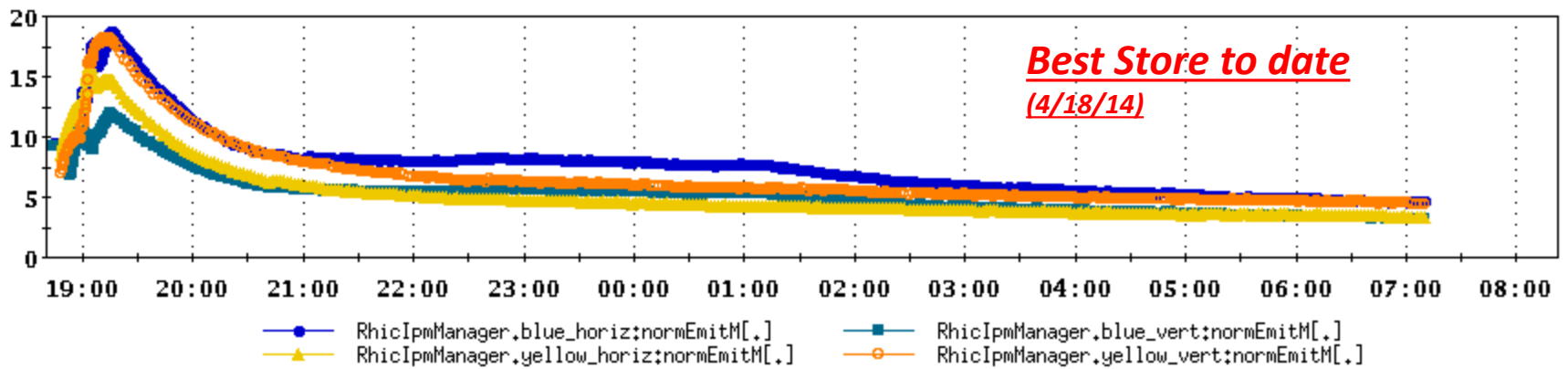
Beam Parameters

Pattern  gamma

Parameters ☒ Display ☐ Fit

	PHENIX	STAR
Number collisions	<input type="text" value="111"/>	<input type="text" value="102"/>
beta* [m]	<input type="text" value="0.70"/>	<input type="text" value="0.70"/>
sMax [m]	<input type="text" value="10.00"/>	<input type="text" value="10.00"/>
sigma [b]	<input type="text" value="9.900"/>	<input type="text" value="9.500"/>
Single Correction	<input type="text" value="All"/>	<input type="text" value="All"/>

Tue Apr 29 12:37:22 2014 -- INFO : Phenix Int Lumi = 193339  
 Tue Apr 29 12:37:22 2014 -- INFO : Star avg Lumi = 57979  
 Tue Apr 29 12:37:22 2014 -- INFO : Star Int Lumi = 208077



## Goals for Run 14 (based on Beam Use Requests)

*(11 Feb, DRAFT, to be updated by experiments)*

### PHENIX

- Au+Au @ 200 GeV for 12 weeks,  $L = 1.5 \text{ nb}^{-1}$  sampled luminosity within  $|z| < 10 \text{ cm}$ 
  - ~30% within  $|z| < 10 \text{ cm}$
  - ~90% DAQ efficiency
  - ~50% bandwidth, DAQ saturation factor (?)
  - 11  $\text{nb}^{-1}$  delivered

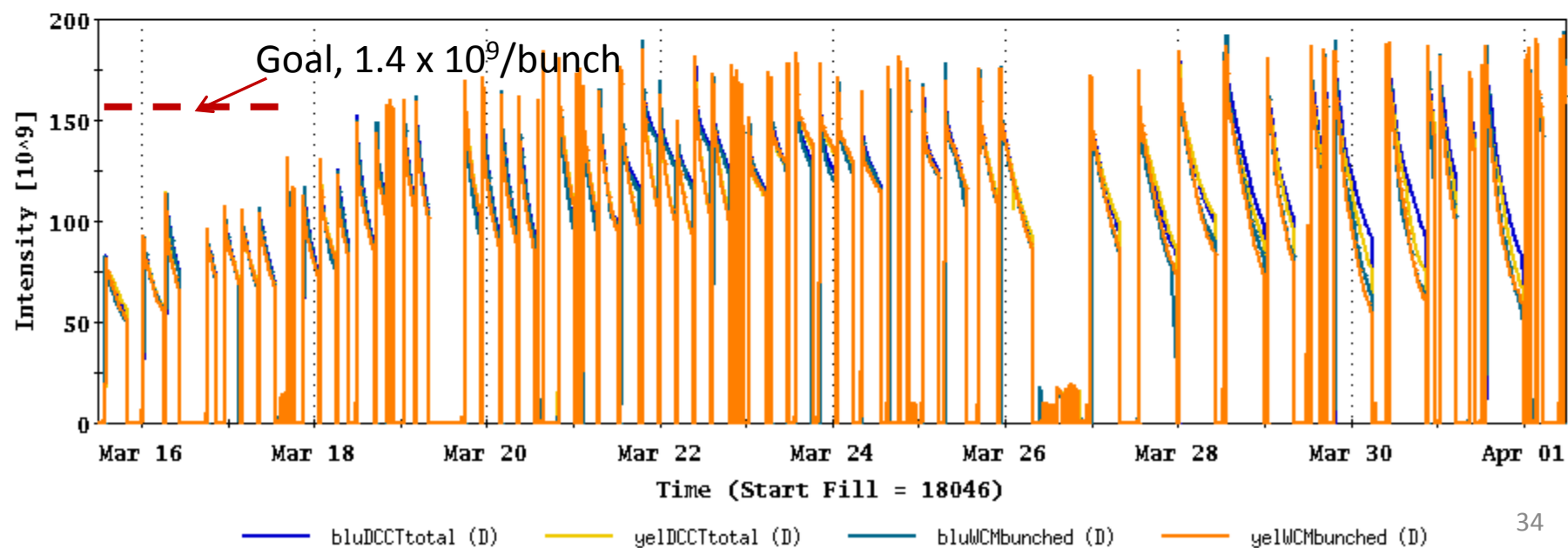
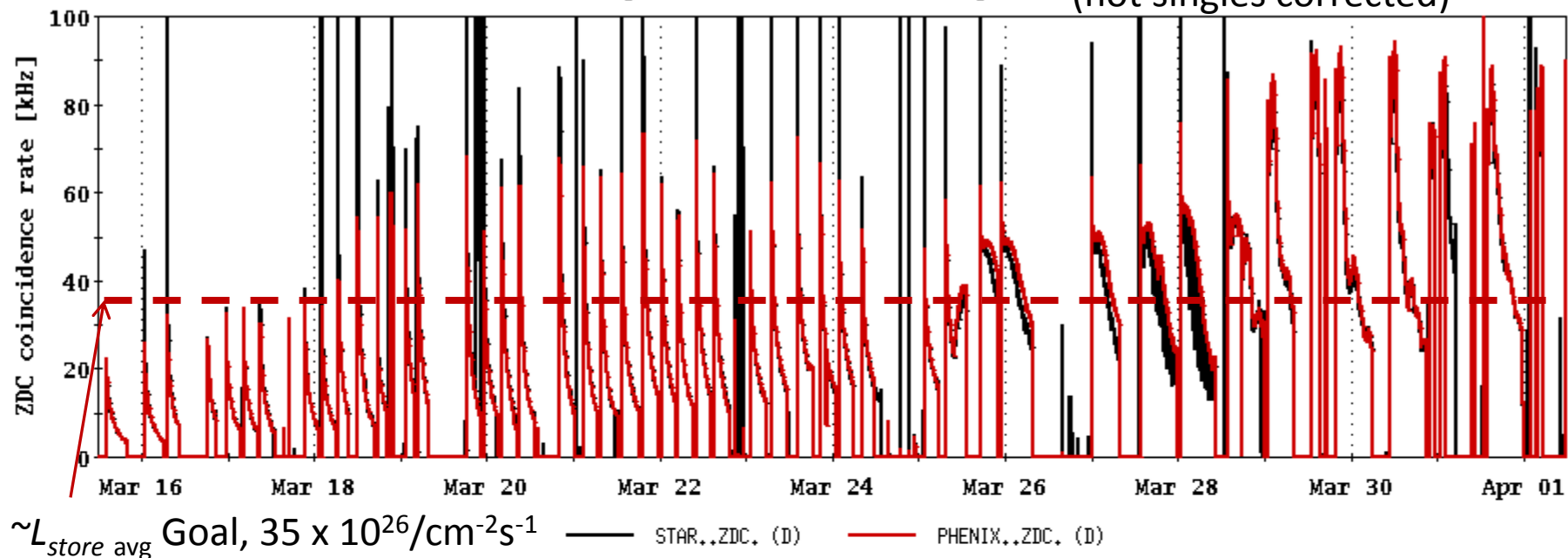
### STAR

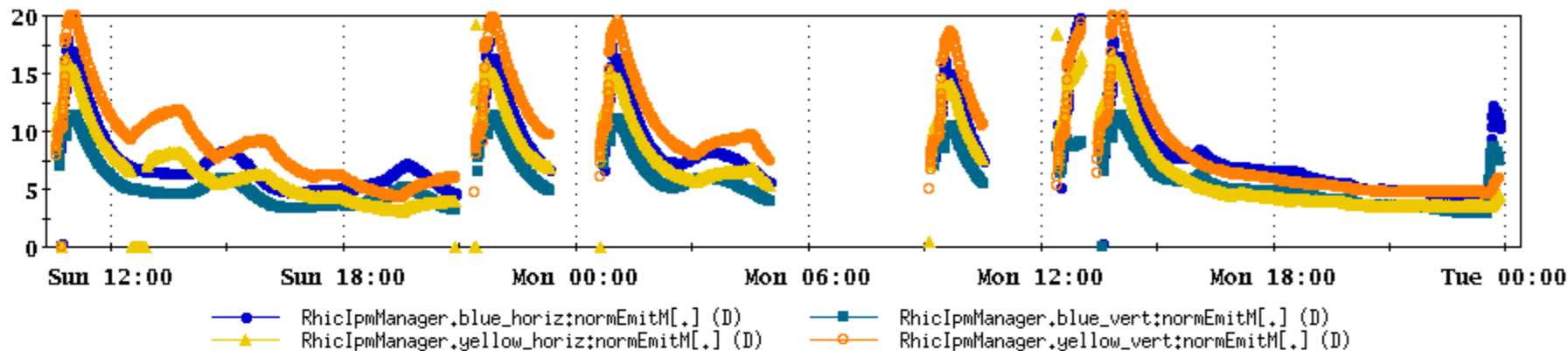
- Au+Au @ 200 GeV for 14 weeks,  $L = 10 \text{ nb}^{-1}$  recorded,  $10^9$  min bias triggers within  $|z| < 5 \text{ cm}$  → ( $2 \times 10^9$  triggers required)
  - ~ 60% (should be better) sampling efficiency
  - 16.7  $\text{nb}^{-1}$  delivered
- Au+Au @ 15 GeV for 3 weeks, 150M min bias triggers

## 4/8/2014 New Electric Rates for this year

FY2014 Rates						
	Original	Revised xxxx				
Month	\$/MWh	\$/MWh				
13-Oct	62	62				
13-Nov	62	62				
13-Dec	62	62				
14-Jan	56	56				
14-Feb	56	56	delta	~ average MW	additional cost at 27 MW	
14-Mar	56	62	\$ 6.00	\$ 27.00	\$ 120,528	
14-Apr	56	62	\$ 6.00	\$ 27.00	\$ 116,640	
14-May	56	62	\$ 6.00	\$ 27.00	\$ 120,528	
14-Jun	69	74	\$ 5.00	\$ 27.00	\$ 97,200	
14-Jul	69	74	\$ 5.00	\$ 5.00	\$ 18,600	
14-Aug	69	74	\$ 5.00	\$ 5.00	\$ 18,600	
14-Sep	69	74	\$ 5.00	\$ 5.00	\$ 18,000	
					\$ 510,096	

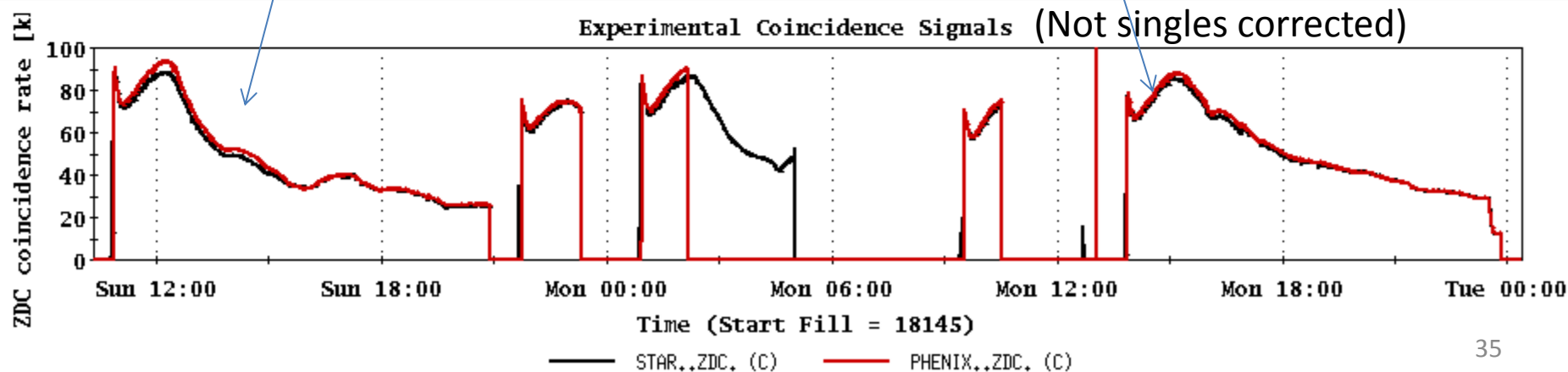
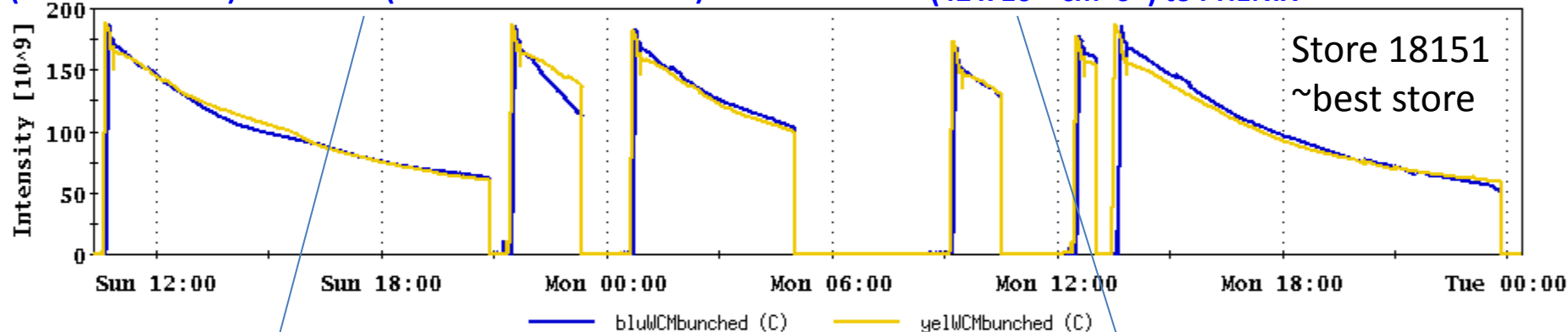
# Experimental Coincidence Signals (not singles corrected)





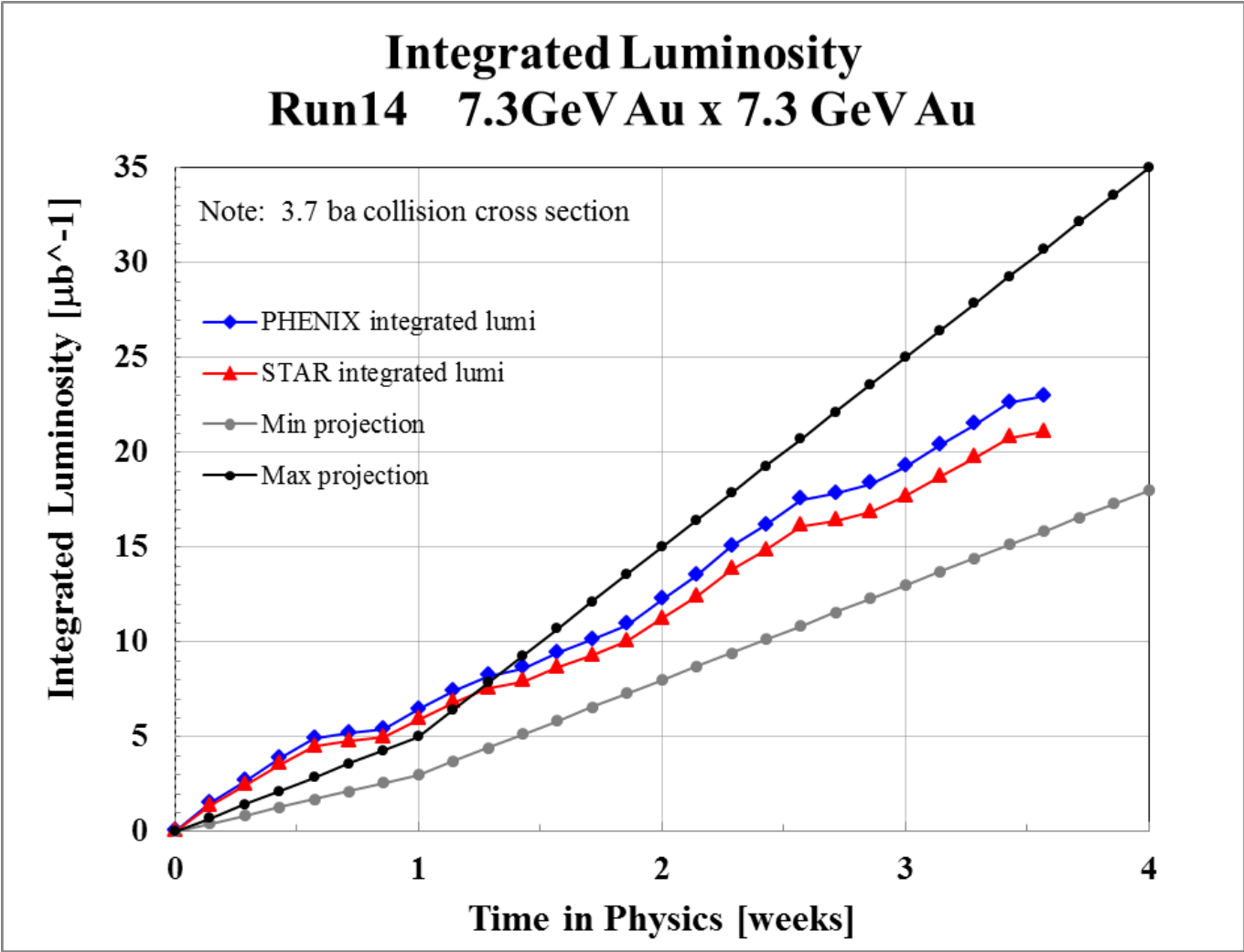
30 Mar, Store 18145, 9 hr 59 min,  $0.143 \text{ nb}^{-1}$   
 ( $40 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$ ) to PHENIX (assumes 9.5 b xscetion)

31 Mar, Store 18151, 9 hr 49 min,  $0.149 \text{ nb}^{-1}$   
 ( $42 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$ ) to PHENIX



Through final fill 18010, 11 Mar 2015

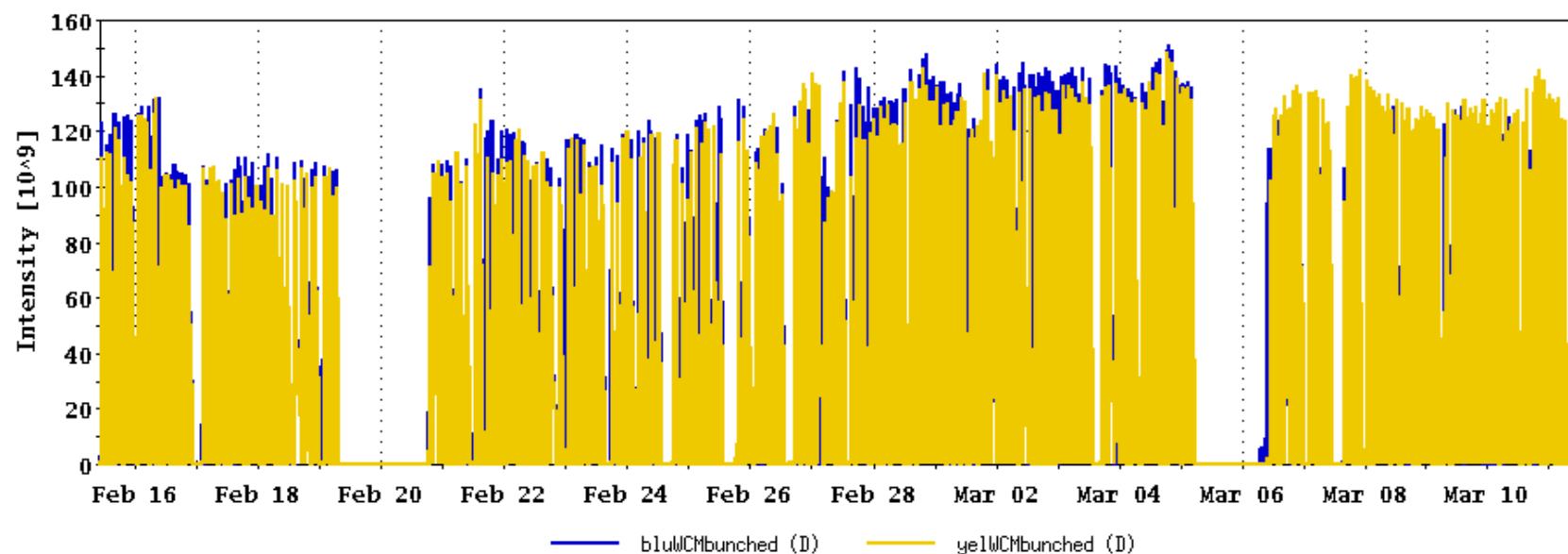
max/min projections from Fischer et.al. "RHIC Collider Projections (FY2014-FY2018)", 4 June 2013



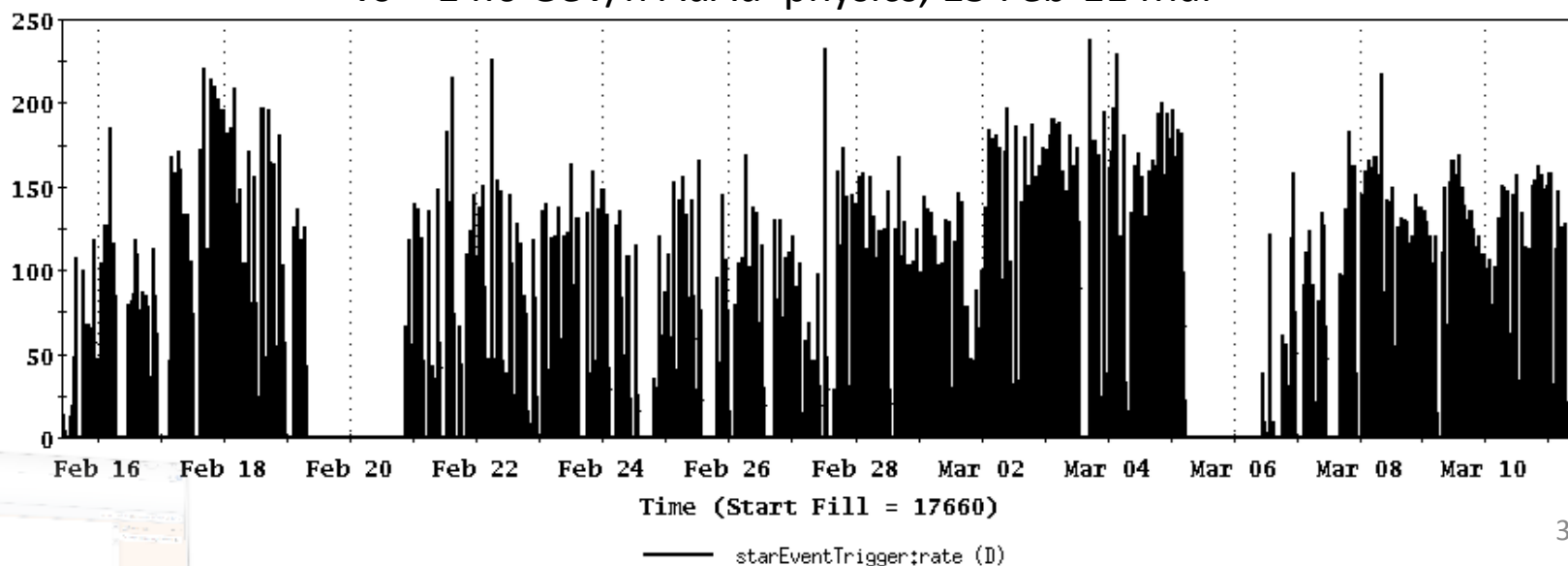
From Ingrassia,

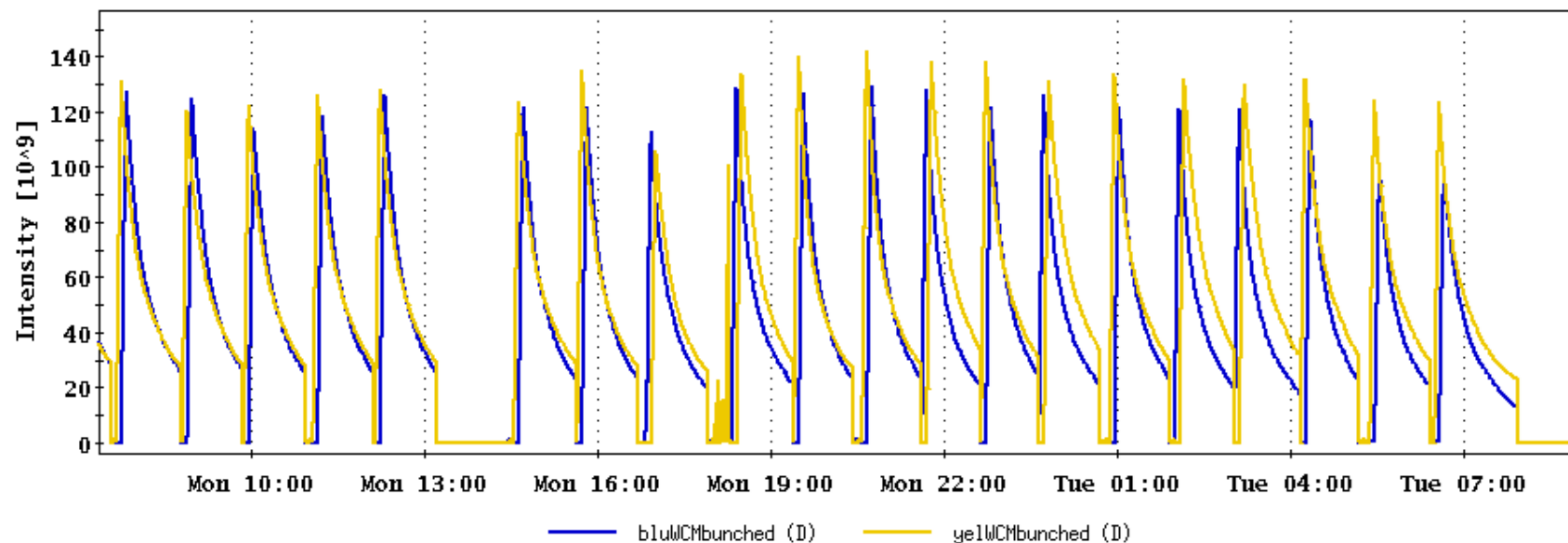
<http://www.cadops.bnl.gov/AGS/Operations/Run14/>

File Window Markers Analysis

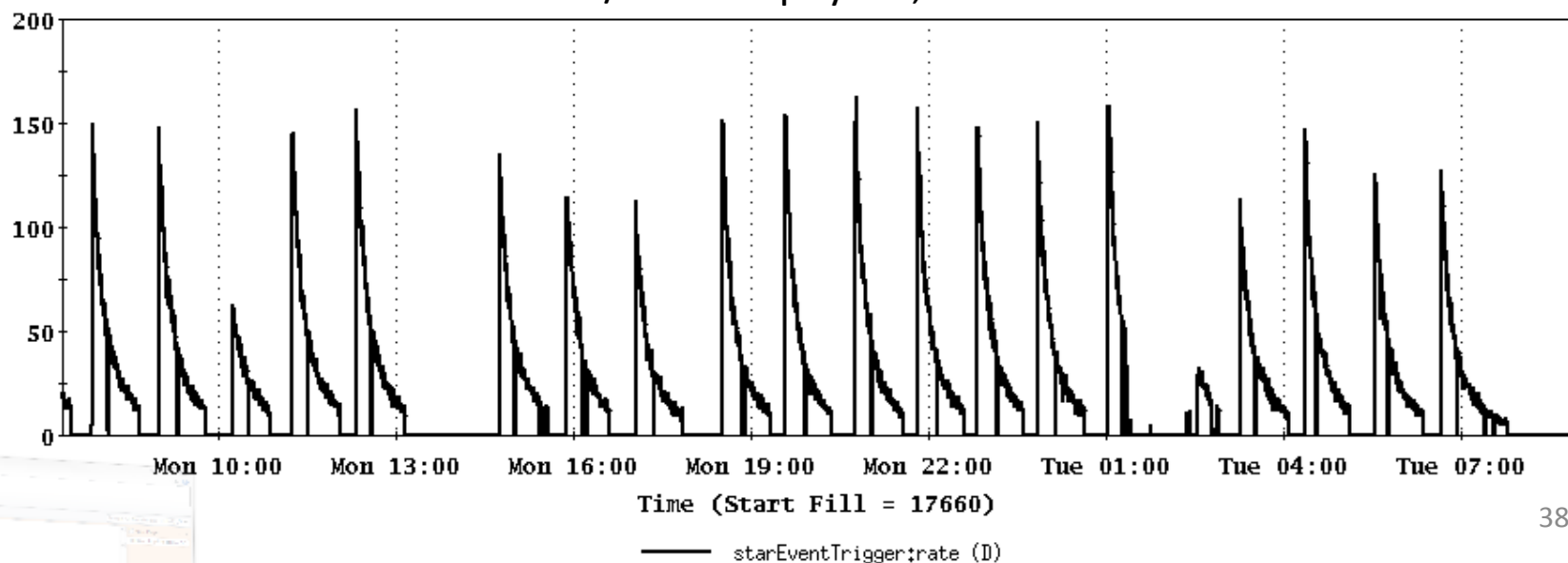


$\sqrt{s} = 14.6$  GeV/n AuAu physics, 15 Feb-11 Mar








$\sqrt{s} = 14.6$  GeV/n AuAu physics, last 24 hours

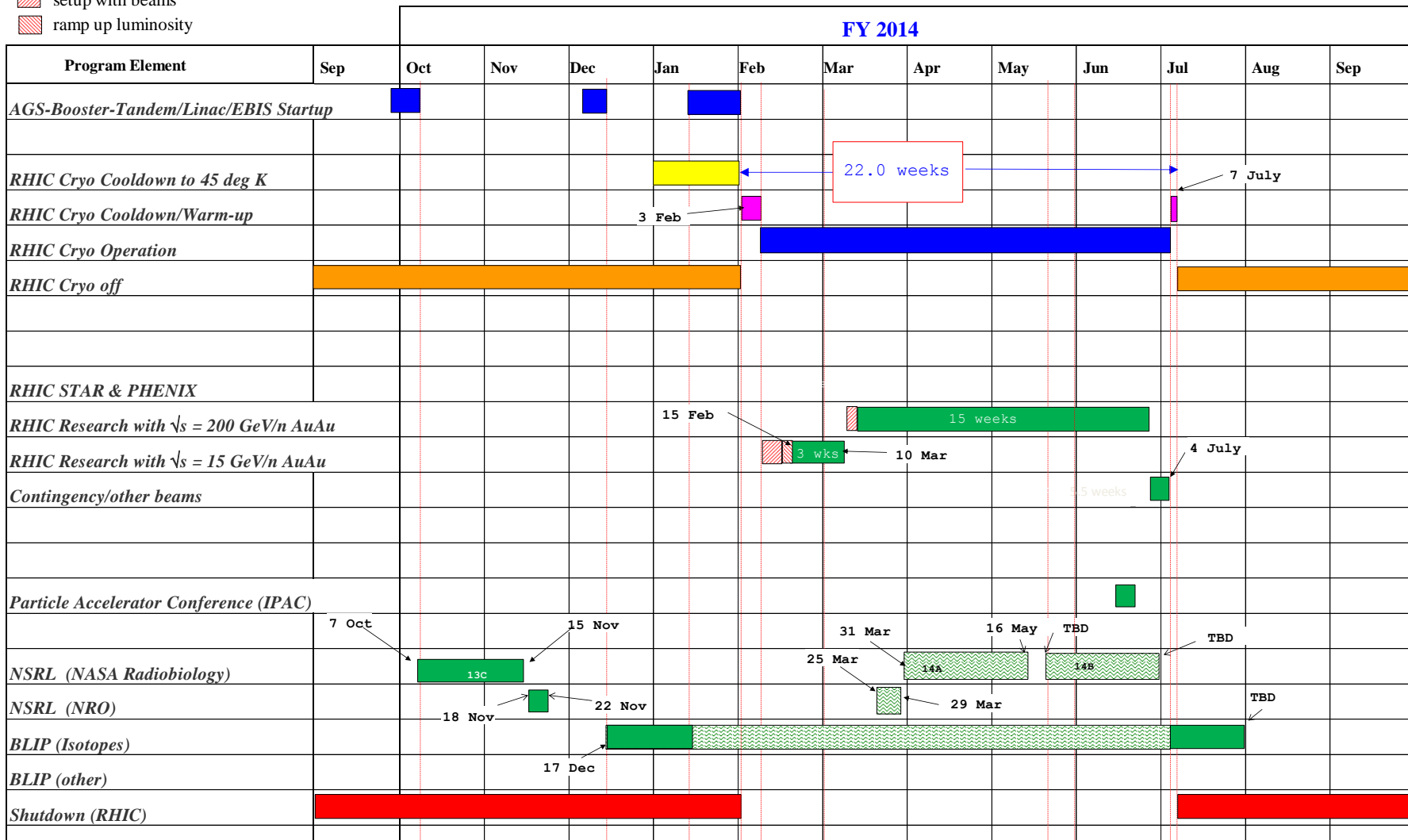


# C-A Operations-FY14

4 Mar 14

*planned, budget permitting*

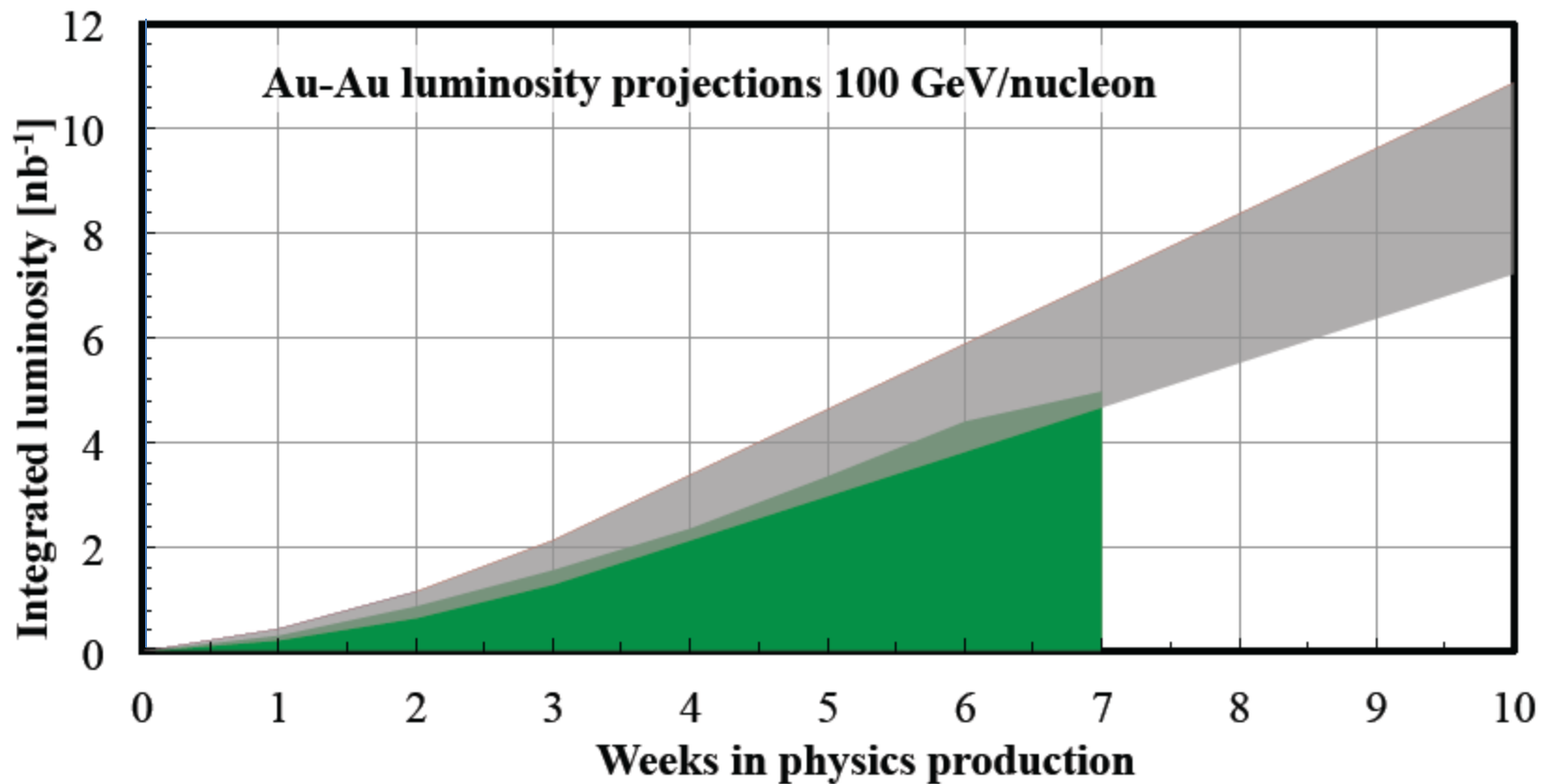
-  concurrent with RHIC
-  setup with beams
-  ramp up luminosity



**Table 2: Maximum luminosities that can be reached after a sufficiently long running period. The beam energy is stated. Other ion combinations can be estimated on demand. For species combinations not yet run the minimum luminosities are approximately 50% of the maximum.**

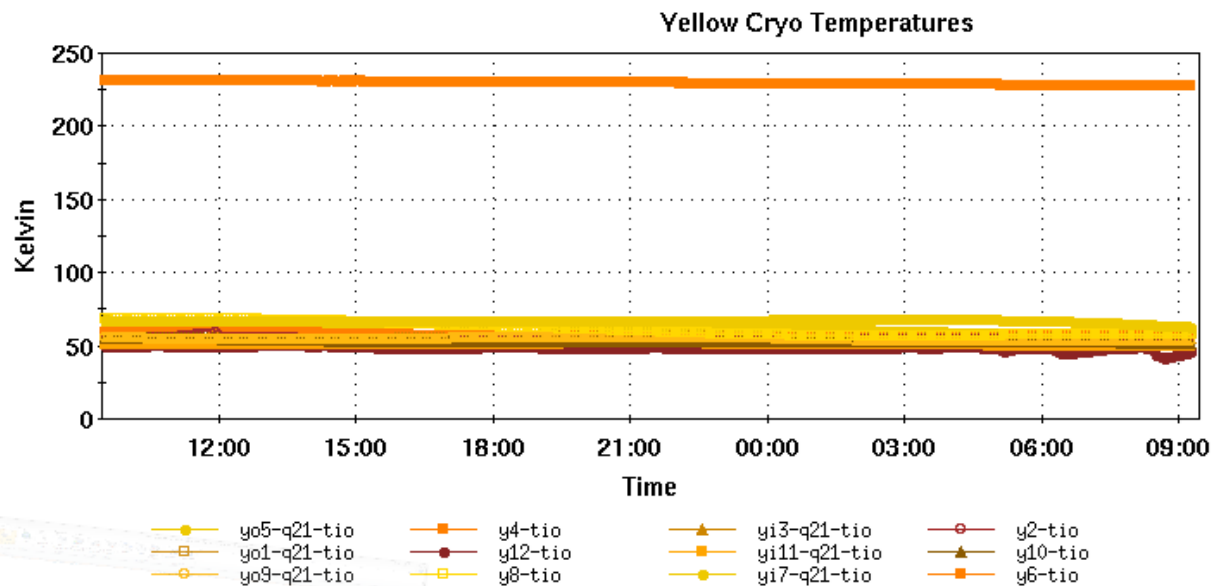
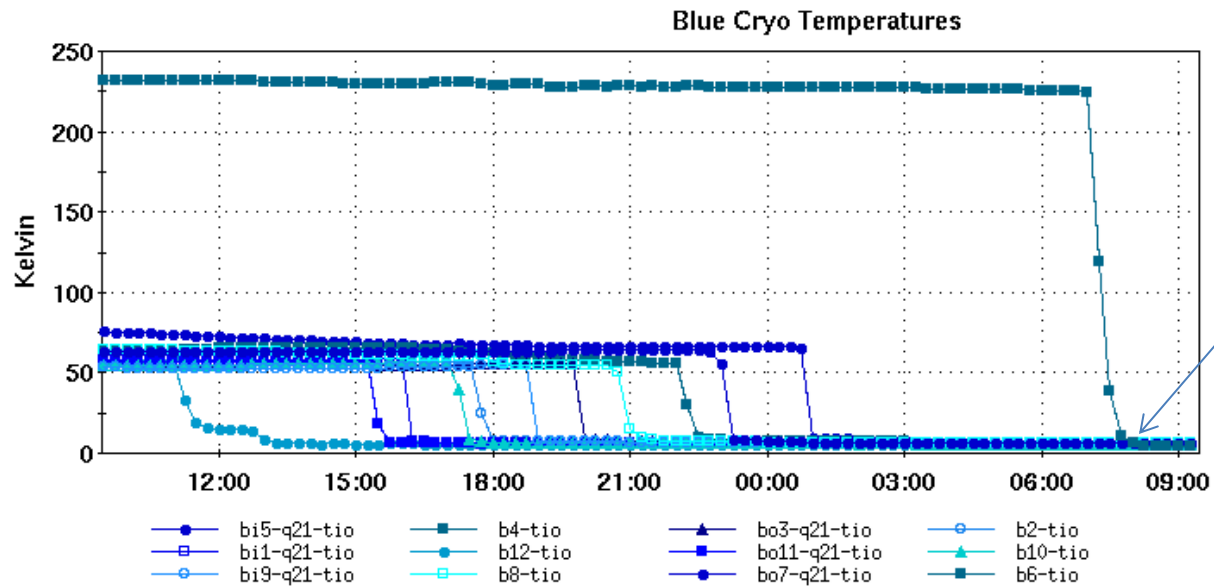
Mode	Beam energy [GeV/n]	No of colliding bunches	Ions/bunch [10 <sup>9</sup> ]	$\beta^*$ [m]	Emittance [mm]	$L_{\text{peak}}$ [cm <sup>-2</sup> s <sup>-1</sup> ]	$L_{\text{store avg}}$ [cm <sup>-2</sup> s <sup>-1</sup> ]	$L_{\text{week}}$
Pb-Pb	98.3	111	1.1	0.7	23→8	20×10 <sup>26</sup>	17×10 <sup>26</sup>	0.6 nb <sup>-1</sup>
Au-Au	100	111	1.4	0.7	23→8	40×10 <sup>26</sup>	35×10 <sup>26</sup>	1.2 nb <sup>-1</sup>
h-Au *	100	111	20 / 1.3	0.8	20→23	8×10 <sup>28</sup>	5×10 <sup>28</sup>	16 nb <sup>-1</sup>
d-Au *	100	111	110 / 1.4	0.8	17→25	47×10 <sup>28</sup>	28×10 <sup>28</sup>	95 nb <sup>-1</sup>
p↑-C	100	111	180 / 20	0.8	18→23	10×10 <sup>32</sup>	7×10 <sup>32</sup>	2.3 pb <sup>-1</sup>
p↑-Cu	100	111	180 / 4.0	0.8	18→23	200×10 <sup>28</sup>	150×10 <sup>28</sup>	475 nb <sup>-1</sup>
p↑-Au	100	111	180 / 1.4	0.8	18→23	70×10 <sup>28</sup>	50×10 <sup>28</sup>	165 nb <sup>-1</sup>
p↑-p↑*	100	107	160	0.85	17→25	65×10 <sup>30</sup>	38×10 <sup>30</sup>	14 pb <sup>-1</sup>
p↑-p↑*	255	107	200	0.65	20→25	280×10 <sup>30</sup>	170×10 <sup>30</sup>	56 pb <sup>-1</sup>

\* h (helion) – nucleus of the <sup>3</sup>He atom; d (deuteron) – nucleus of the <sup>2</sup>H atom; p (proton) – nucleus of the <sup>1</sup>H atom.  
 \* We expect that an intensity- and time-averaged store polarization  $P$  of up to 65%, as measured by the H jet, can be reached at 100 GeV. At 255 GeV we expect the polarization  $P$  to reach up to 57%. In Run-11 PHENIX had 107 and STAR 102 colliding bunches.



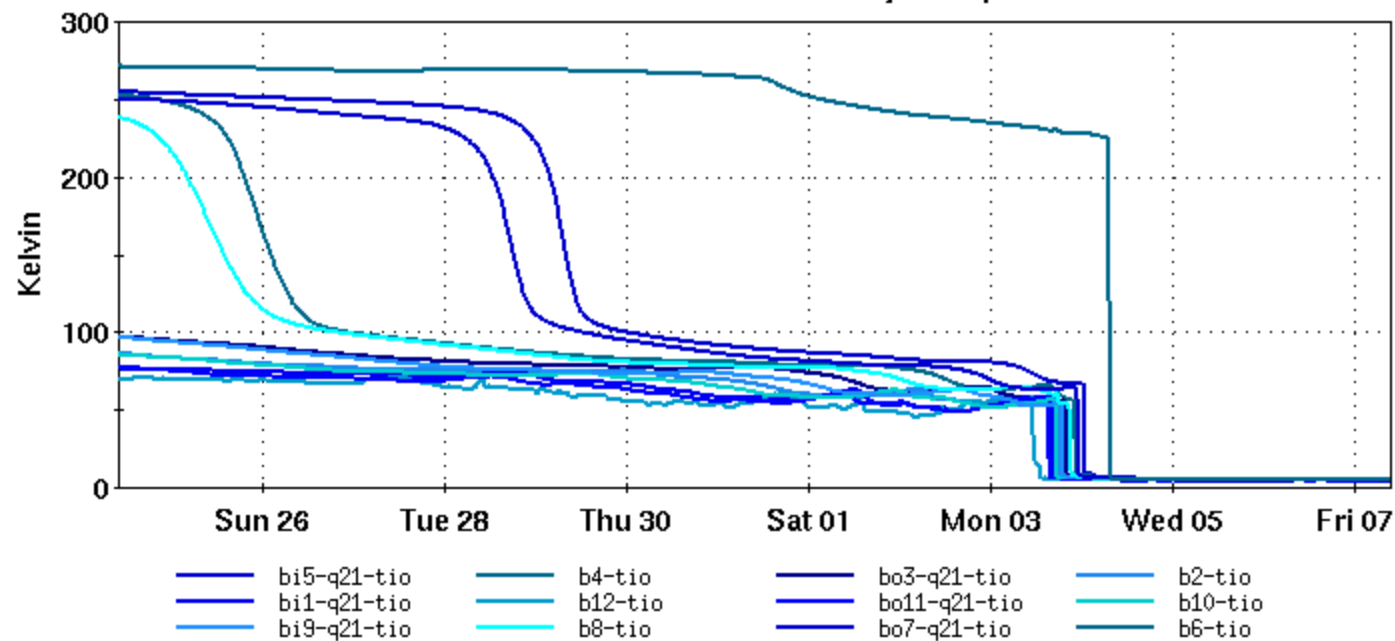
**Figure 4: Projected minimum and maximum integrated luminosities for Au-Au at 100 GeV/nucleon.**

File Window Markers Analysis

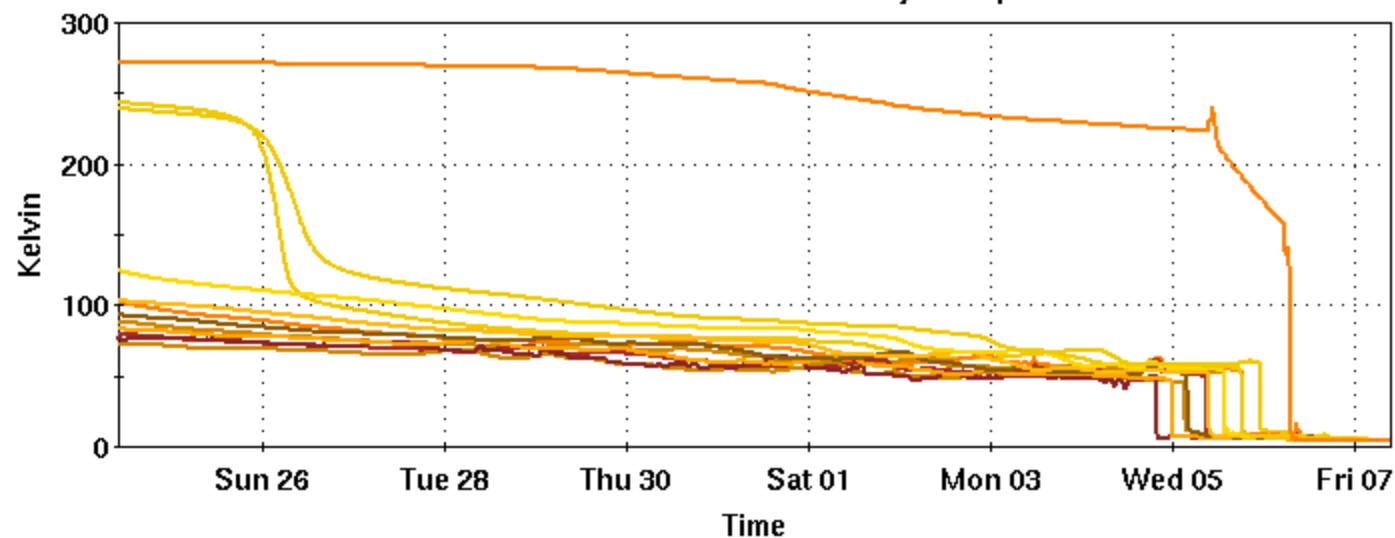


7 Feb 2014, Blue and Yellow at 4.5 deg K

Blue Cryo Temperatures



Yellow Cryo Temperatures



## Who's Who for 2014

RHIC Au-Au Run Coordinator Operations:	<a href="#">Gregory Marr</a>	<a href="mailto:gmarr@bnl.gov">gmarr@bnl.gov</a>	631-344-7810 (office)
	<a href="#">Vincent Schoefer</a>	<a href="mailto:schoefer@bnl.gov">schoefer@bnl.gov</a>	631-344-8453 (office)
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For example, 20 weeks of RHIC refrigerator operation in FY 2014 could be scheduled in the following way:

Cool-down from 50 K to 4 K	1 week	
Set-up mode 1 (Au-Au at 7.5 GeV/nucleon)	1 week	(no dedicated time for experiments)
Ramp-up mode 1	$\frac{1}{2}$ weeks	(8 h/night for experiments)
Data taking mode 1	2 $\frac{1}{2}$ weeks	
Set-up mode 2 (Au-Au at 100 GeV/nucleon)	$\frac{1}{2}$ week	(no dedicated time for experiments)
Data taking mode 2 with further ramp-up	10 weeks	
Set-up mode 3 (p $\uparrow$ -p $\uparrow$ at 100 GeV)	1 week	(no dedicated time for experiments)
Ramp-up mode 3	$\frac{1}{2}$ weeks	(8 h/night for experiments)
Data taking mode 3+1 with further ramp-up	2 $\frac{1}{2}$ weeks	
Warm-up	$\frac{1}{2}$ week	

**From Fischer et. al., RHIC Collider Projections (FY 2014 – FY 2018), 4 June 2013**